AMERICAN GAS JOURNAL

MARCH 1941

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The Ejector Principle

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The EMCO Type B Ejector Service Regulator provides the gas distribution engineer with three definite improvements in service regulator performance—effective automatic loading, low shutoff and increased capacity.

In earlier service regulator designs, when the consumer used more gas, the outlet pressure, gauged a few inches from the outlet of the regulator, went down. This gave a bad effect, in that along with increase in volume, the drop through the meter increased as well as the drop through the piping to the appliances, so that as more appliances were added to the load, the pressure at the appliances dropped and combustion was adversely affected.

The advent of the EMCO Type B Ejector Regulator, in which the outlet pressure is automatically increased as the rate of flow through the regulator increases, enables the distribution engineer to successfully combat this condition and at the same time affords a means for the gas company to provide more satisfactory service to its customers and to better its public relations.

IT is of extreme importance that service regulators, whose principal function is to reduce higher distribution pressures to safe pressures for the meter and house piping, perform this task of reducing with a maximum of safety. Over-pressure in the house piping can have some very serious effects. First, leaks due to over-pressure or the meter or some other part of the system might result, also pilot valves may not function properly or be extinguished; and, even more important, burners might generate carbon monoxide while operating at a pressure higher than that for which they are adjusted.

In the past, several methods to avoid this over-pressure condition have been used. The mercury seal and deadweight safety valve methods have been the most commonly used. Both have certain inherent design defects which have worked against their universal adoption.

A very successful, satisfactory and simple solution to this problem of safety is offered in the EMCO Internal Relief Valve, shown in the sectional view below. In this design a high degree of accuracy both in relieving and in resealing is obtained by using the entire main diaphragm as the relieving pressure area. Thus, once the blowing point is determined, it will operate at this point exactly when required, and reseal, on the pressure decreasing, at a point consistently close to the blowing point.

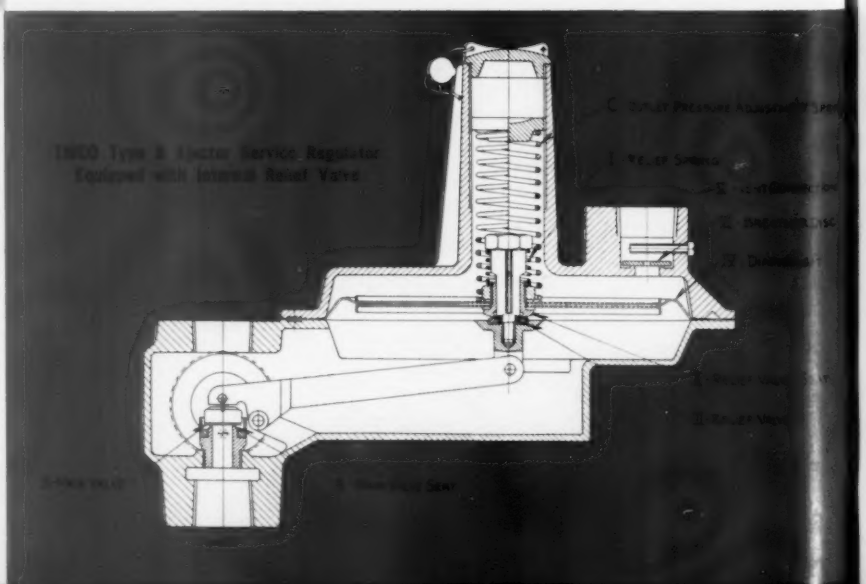
The use of the internal relief valve in combination with the Ejector principle provides, in the EMCO Type B Ejector Regulator, safety and exceptional regulation performance.

For complete information about the EMCO Type B Ejector Regulator with Internal Relief Valve request a copy of Bulletin 1065.

How it works —

Operation of the internal relief valve is explained by referring to the accompanying illustration. In normal operation, as a pressure regulator under standard conditions, spring I operates to hold valve III on seat II. Spring I is a heavy, non-adjustable spring, and can exert a very strong force to insure a tight closing of the valve III, on soft seat II. If because of dirt on the main regulator valve, or a nicked seat, main valve B fails to close, pressure will build up under the main diaphragm IV, above the normal lock off pressure. When this pressure increase, multiplied by the area of the large diaphragm IV, is sufficient to overcome spring I, valve III is raised off its seat, and the excess pressure is relieved through the fluted area of valve III, into the top diaphragm chamber. Thence, this gas flows out through vent connection V, by raising breather disc VI. Obviously, vent connection must be piped to a safe place for the venting of unburned gas. On relieving this over-pressure, spring I will close the valve. Valve III is guided accurately to its seat, thus insuring a positive shutoff.

It will be seen that spring I is selected to operate at a definite rise in pressure above a *normal lock off pressure*. Thus, the relieving pressure will vary with the adjustment pressure, insuring sufficient gap between the two under all conditions so that a too frequent blowing of the seal will not take place, but providing a positive relief below any dangerous pressure.



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	3.	8' 0"	New	520	100% Bituminous and Bunker C Oil
	4.	12' 0"	New	800	Coke and Gas Oil
	5.	10' 0"	New	535	Coke and Bunker C Oil
	6.	7' 0"	Conversion	530	100% Bituminous and Bunker C Oil
	7.	10' 0"	New	535	Coke and Bunker C Oil
	8.	10' 0"	Conversion	540	100% Bituminous and No. 5 Fuel Oil
	9.	9' 0"	New	535	100% Bituminous and No. 5 Fuel Oil
	10.	7' 0"	New	535	Anthracite and Gas Oil

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40 Rector Street **New York, N. Y.**

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Tighten bolt.

Drill hole in pipe.

Connect outlet.

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Contents

War Economy and the Gas Industry—T. J. Strickler 9

Operating Division Wrinkles—W. W. Gardner 11

Dessert Maker Finds Gas Fired Boiler Efficient—John E. Hubel 14

Air Humidity—Part 2—O. J. Kuenhold 15

Review of Late 1940 Gas Company Injury Suits—Leo T. Parker 18

Two Engineering Aids—W. F. Schaphorst 20

Selling Gas Heat in the Nation's Capital—A. J. Maloney 21

Flow of Gas Through Pipes—R. Vittinghoff and H. Vittinghoff 29

B. C. Electric Has Vigorous Gas Campaign in Progress—F. H. Fullerton 33

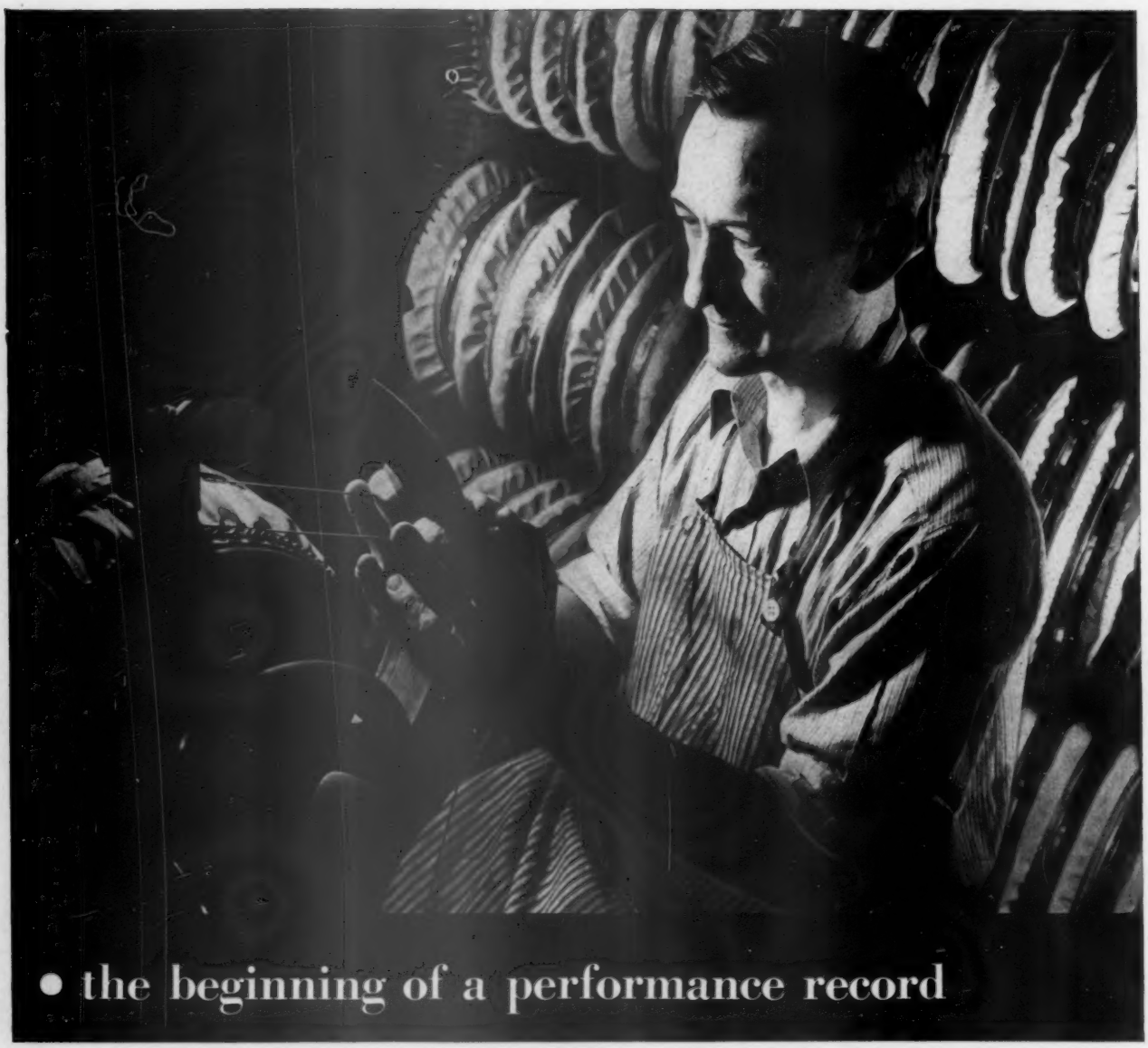
Studies in Microbiological Anaerobic Corrosion—Part 3—Raymond F. Hadley 35

The Vegetation Method of Locating Gas Leaks—Milton W. Heath 39

News of the Gas Industry 42

Thirty-Third Annual Convention Southern Gas Association ... 45

Midwest Regional Sales Conference 45



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MARCH
1941

AMERICAN
GAS JOURNAL

VOLUME 154
No. 3

War Economy and the Gas Industry

By
Thomas J. Strickler
President, American Gas Association
Vice Pres. and General Manager
Kansas City Gas Co.

THIS happens to be my first appearance at a convention of fellow-utility workers in my new capacity as President of the American Gas Association. Please believe me when I say I am deeply appreciative of the invitation you have extended to me to be present with you. I congratulate you on the program for your convention and sales conference, and am confident this meeting will measure up to the high standard set by former meetings sponsored by the Southern Gas Association.

It is unfortunate that the present turbulent condition of world affairs makes it necessary for me to comment on matters of very great national importance to all of us, rather than to devote my talk to a discussion of subjects of a purely gas industry interest which would normally be the case. I feel that I would be side-stepping the obligations of my office if I did not use this occasion and perhaps others to follow, to state some things that require our matured and serious consideration in these extraordinary times.

First, as an introduction to what is to follow, let me make this declaration. I take issue with those who claim that America is today facing a crisis. I don't like the word. It smacks too much of a spirit of defeatism. America does not face a crisis. It faces a challenge. It may take all that we have to meet that challenge, but we shall do it successfully and shall be rewarded accordingly when peace finally comes. The time is here and now when clear thinking, good judgment, a healthy mental outlook, wise and courageous leadership, shrewd management, sound patriotism and hard work are the answers, and the only answers, to the special problems that face us as members of the gas industry and as citizens of the United States. Let us arm ourselves with such weapons and we need not fear the future.

T. J. Strickler *Sudvarg Studio*

Much against our will we find ourselves transformed from a nation which desires peace to one which must exert its best efforts to prepare to defend itself. For months on end national defense has been our most discussed topic, and it will continue to be even more so in the months ahead.

So great are the demands that our country's vast industrial machine is being strained, and it must still take on added demands as the necessity for speed becomes more and more important. Already the government has found it necessary to underwrite plant expansion, set up reserves of strategic and critical materials, aid in the financing of preparedness contracts and to do many things to prime the productive pump for our national defense.

Industry is responding, and that includes the gas industry. The picture is so complicated, however, and it changes so rapidly that none of us can foretell with certainty how great the effort will have to be before this new year has run its course. Jesse H. Jones, Secretary of Commerce, puts it this way:

"It may become necessary for us to do in one day what we ordinarily would do in three or four. We may be forced to devote all of our energies to what is now only a part-time undertaking. When that time comes, no segment of government or industry, no part of our citizenry will be able to give less than a full measure. Every citizen will then be called upon for the service he is best able to render."

The full impact of the government's tremendous spending program has not yet been felt by American business. Many lines of business will be stimulated to capacity

production. Millions of men are being put back to work and more will be employed later. The steel industry, makers of tools and dies, shipyards and automotive and aviation factories can expect activity that will surpass any previous year in their history. Over the near-term future, companies which are financially sound and well-managed need have no apprehension. The gas utility business clearly comes within this definition.

Right now new markets are being created. There will be an increase in the real wealth of the country in new houses and structures. There will be an increase in the skill of American workmen, much of which was arrested during the period of depression. This rehabilitation of labor will stimulate desires for goods of all types. The increased volume of business will expand national income and also tax revenues available to the government.

In the days that lie immediately ahead some companies may have to adjust all or part of their facilities for manufacturing materials for the government. Other companies, and here is where the gas industry comes in for mention, will play no less a part in our national defense if they take a more aggressive stand for the marketing of their products. It will be their function to keep up or increase the flow of consumer goods and services so necessary to the prosperity, health, happiness and morale of our people. This flow of consumer goods and services is, after all, the life blood of this nation. Under normal conditions the principal concern of business is to maintain and develop established markets and channels of distribution. It is hoped that this policy will remain a dominant factor in business under the national defense program, even though normal markets and distribution methods may undergo some temporary dislocations.

Much depends on the action to be taken by Congress. It will have to decide which of two roads it is going to take. In other words, it will have the choice of subordinating all that it does—or intends to do—to national defense or—preparing for national defense and at the same time safeguarding and strengthening our national economy. The two policies are quite different. One would take into account only the emergency we face. The other would also take into account the ordinary, day-to-day tasks we have to do. Congress can put the need for defense above all other considerations, and make it a first claim upon any and all resources that may be needed to accomplish that purpose, or it can regard national defense as part of the bigger job of developing and preserving a strong and vigorous nation.

And now let us consider the effect all of this is likely to have on the gas industry in the immediate future. In the first place, no industry is more vitally important in a program of national defense than the business in which you and I are engaged. Therefore, let us not underestimate the big part that gas fuel will play in the coming months. The basis of all war preparations is heat, and no other form of heat can equal gas fuel for its flexibility, ease of control and efficiency.

Two tasks face us, and we dare not fail in meeting both of them adequately. One is the ability of our industry to assume the heavy industrial work of assisting in turning out the manifold implements of war. The other is to make sure that the service we render to millions of American homes will be maintained at a high rate of efficiency. The two go hand in hand—national defense and a smoothly running economic machine. One job cannot be done well without the other. Therein lies our double obligation.

Consider for a moment the record of progress made by the gas industry during the last year. It is one that merits congratulation. We ended 1940 with the largest number of customers ever connected to our mains —a gain of 481,000 new customers during the year. Also, more ranges were sold in 1940 than in any previous year in our history. Complete figures will be available later and they will show substantial increases in the sale of all domestic appliances —a splendid demonstration of the ability of our sales personnel to carry the fight successfully to completion.

Revenues of the entire industry, both manufactured and natural, established a gain of 7.3% for 1940 over the preceding year. In every department of our business the statistics for 1940 make pleasant reading.

We enter upon the new year ideally fitted as a basic fuel-purveying industry to meet the vast industrial heating needs of factories and mills that are producing the thousands of parts for equipment and machines necessary in a period of war economy. In the hardening of small and intricate parts of machine guns to the final heat treatment of the largest guns, specially designed gas furnaces are speeding production on an ever increasing basis. In the navy yards some of the largest industrial furnaces ever built are annealing fully assembled gun turrets with gas. Equipment which has been developed for peacetime use during the last decade through cooperative research and engineering by the gas utilities and leading manufacturers under the sponsorship of the American Gas Association is rapidly being put to work to speed up production in war industries.

As I have said previously we face a challenge. How shall we meet it? We dare not curtail our selling efforts, cut our advertising to the bone or permit our hard-won markets to be invaded by others who are waiting only for the signal to do so. This industry of ours is an old and rugged one. It has survived in its stride every panic and every war and every period of emergency. It has a time-tested record for stability that few other industries can match.

So, I say, it is of supreme importance that we plan calmly and courageously. Not for one moment should we sit back and allow the present course of extraordinary events to shape our destinies. Let us beware of mass hysteria and the temptation to succumb to it, even temporarily. Let us face the future with complete confidence in the nation, in ourselves and in our business. Finally, let us fight every effort that may be made to throw overboard the results of years of sound planning in favor of emotionally dictated decisions which seem expedient at the moment. Steer that kind of course and it will not only aid the gas industry but it will serve to accomplish that greater objective which is to keep America American.

From address presented at the Southern-Southwestern Regional Gas Sales Conference, Dallas, Texas, February 12, 1941.

Operating Division "Wrinkles"

By

W. W. Gardner

Gas Engineer
The Connecticut Light and Power Co.

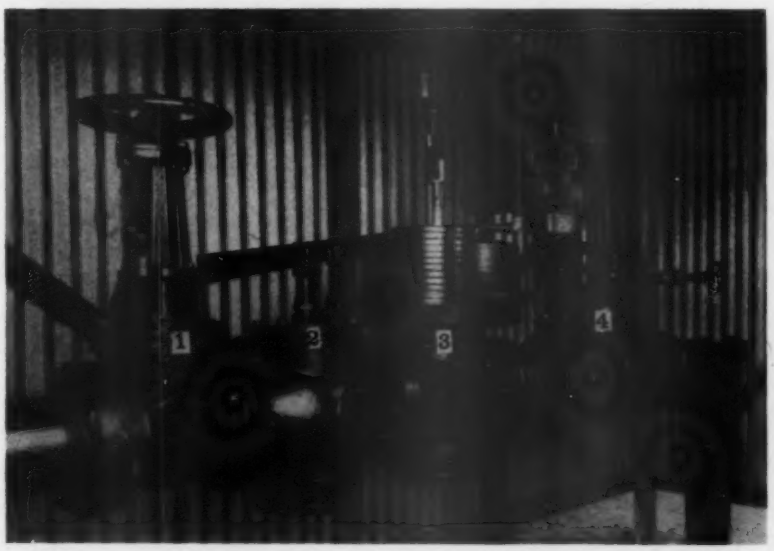
Unattended Holder Control Installation

To make available for more pressing work, the services of three shift men who had very little to do other than open and close a valve, an entirely automatic holder control was installed in our plant in Middletown.

Gas at 6 lbs. or more pressure is brought up to a Connelly lever actuated valve which opens and closes through the action of a cable connected to the lever and a weight resting on a platform on the bottom of the lower lift of the holder. As the holder falls, the valve is gradually opened wide. A locked valve beyond this Connelly valve regulates the gas flow into the holder keeping it at constant and uniform rate.

Ahead of the control valve a Connelly reverse flow governor is installed. Should pressure on the incoming gas fall to 2 lbs. this valve closes automatically, preventing holder gas flowing back into the line.

Unattended automatic holder control at Middletown, Conn. On the left, the control housing in the foreground. Control cable is in the pipe extending upward to the housing over the pulley arrangement, shown by arrow. On the right, pulley arrangement for cable with the housing removed.

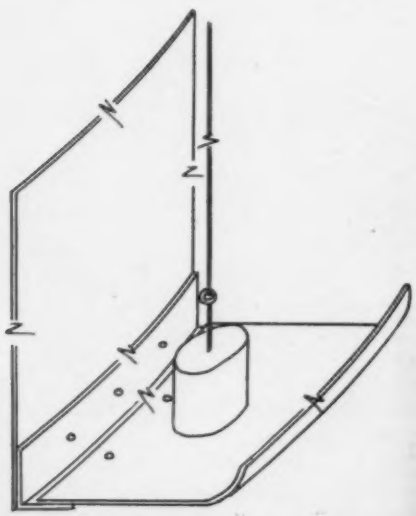


Valve arrangement in control housing:—(1) Control valve; (2) Filler valve; (3) Reserve flow governor; (4) Electric valve.

The electric valve shown in the picture was incorporated in the installation as an auxiliary. Formerly it was located in a flood area and not readily accessible. Since the electric valve was installed, it has been inoperative.

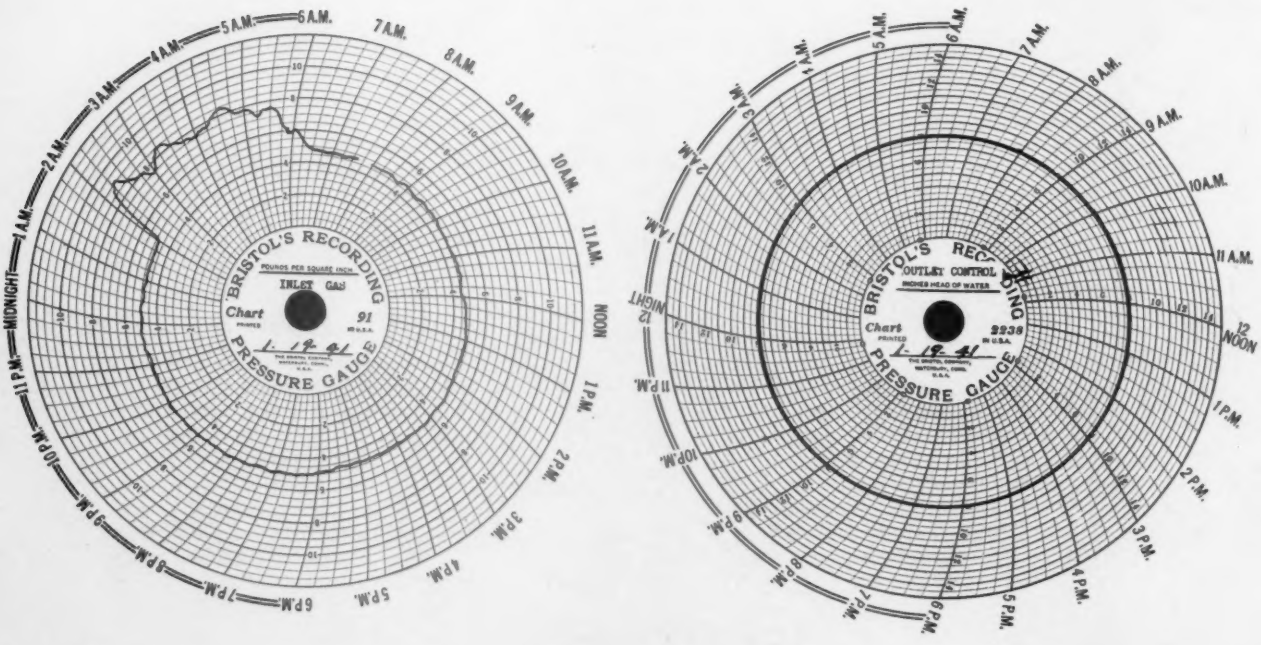
The Connelly metal seat valve has given a positive shut off as the charts show. In this 300 M, 2 lift holder, we are passing 6 to 750 M per 24 hours. Valve No. 1 is set to pass 20 to 30 ft. per hour depending on the anticipated seasonal demand and rarely has to be changed more often than once in 2 weeks.

Connelly valve No. 2 is operated



Sketch of landing platform attached to lower lift of holder 4' below water surface.

Presented before New England Gas Association, Operating Division, Hartford, Conn., October 23, 1940.



These charts show; on the left, inlet gas record, and heavy outline on the right-hand chart shows outlet control.

by a cable operating from the lever and passing upward through the pipe, thence up and over 8" V pulleys above the platform, hence down to weight that contacts platform attached to bottom of holder 4 ft. below water surface. Cable is flexible steel tiller cable, well greased for its entire length.

A detail of the landing platform is shown.

Daily charts record time of valve operation. The housing roof is a half section of a 6'x12' steel culvert within the usual corrugated steel siding

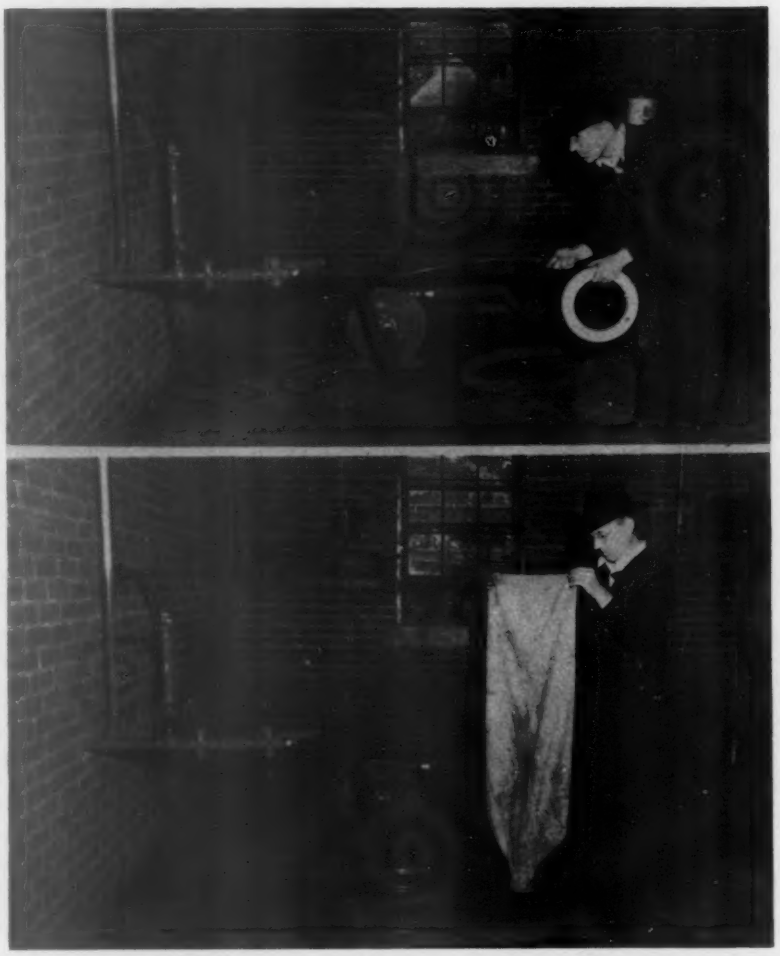
The entire installation is weather proof and requires a minimum of attention.

Aside from a saving in gas storage expense of about $100 a week, we have the services of these men for other essential work during the day. A final inspection of the controls is made at closing time and the holder station is unattended throughout the night.

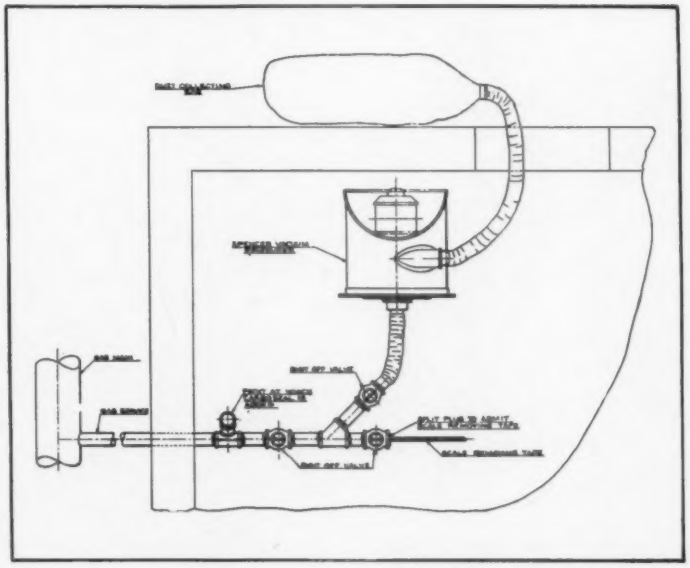
Since installing several months ago, the performance of this control has been most satisfactory.

Dust and Low Pressure Complaints

In one city of our division, we had been experiencing many repeat complaints of pilot outages and it was thought our distribution system was loaded with dust or something in the gas stream. Drip would blow clean and no dust noticeable. Necessary excavations were made, main tapped and looked into and no deposits of any nature found. We cut into a 10



Above, ¾ H. P. Spencer Vacuum Unit connected to gas service. Wire is run into service pipe to loosen deposit. Dust is collected in bag shown outside the window. Below, emptying the bag after the work is completed.



Plan view of Spencer Vacuum Unit.

ft. section of main and found a fluffy like substance adhering to the pipe walls which resembled an oil film.

Further investigation into complaints revealed a deposit in the services that was the basis of our troubles. The old method of blowing the service was abandoned and a different way tried. A wire run into the service to loosen the deposit and an ordinary vacuum cleaner set outside the cellar and connected with the service was used. The results gave a clue to our troubles.

A turbine vacuum cleaner was secured from the Spencer Turbine Co. of Hartford, Connecticut, and the results were most gratifying. This cleaner was set in the cellar and connected directly to the service and the dust bag laid outside the building. The pictures will illustrate this procedure. We now have a clean service brought back to its original capacity.

To complete this job, a pint of Carboseal is poured into the service after cleaning so as to seal the very fine dust remaining after such a drastic stirring up. There has not been a pilot outage or complaint after such a cleaning. In carrying out this method, we set recording and water gauges across the street opposite where we were working to note the effect of a high vacuum on the pressure. The only effect was a drop of 1 to 1½ tenths in pressure.

We have been cleaning services in this manner on all low pressure complaints for over a year and have yet to put out a pilot light outside the premises. The old story of blowing a service and plugging it tight is a thing of the past with us. By this method, we do not blow this deposit back into the main to give us further trouble.

Cleaning by this new method has saved many service replacements which cost $25 to $50 each.

It is surprising how much a service capacity is reduced by this adhering material. As much as 4 to 5 lbs. of rust have been removed from 1¼" services 60' long. Although the amount of deposit may be small, it can cause a restriction that seriously interferes with the gas supply.

By this method, we have cleared up all our troublesome services. It has a bearing on Public Relations as no one likes to see paved streets and lawns dug up. We have found that many of our smaller services have ample capacity after this thorough cleaning.

Gardner–Goodman Stopper

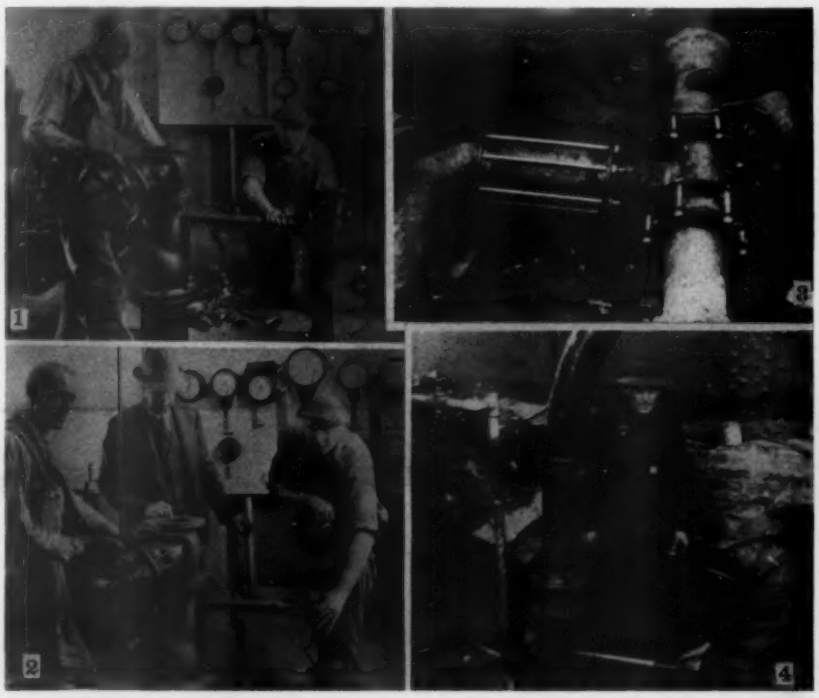
The Gardner-Goodman gas main stopper can be used on low and intermediate pressures with safety and assurance.

These pictures show its adaptability in unusual places and its sales throughout the country and abroad attest its value.

Pilot outages when inserting the old style stoppers are eliminated and our street men do not have to worry about not being able to get into houses to check pilots, when making main extensions, cutting in ties and other incidental work.

Condensate Removal From Trapped Services

Condensation in a gas line from the main to the residence is one of the most troublesome problems gas



1:—Gardner-Goodman stopper in neck of 8 x 6 x 8 tee. No interruptions to City service. 2:—Stopper inspected by Mr. Gardner before removal of valve. 3:—Made up steel tee on C.I. pipe. Section cut out of C.I. main. Cutter withdrawn. Gardner-Goodman stopper inserted and cutting machine removed. 4:—6" Gardner-Goodman stopper being deflated and withdrawn from connection from top of 20" holder drip.

servicemen have. It results in decreased or fluctuating pressure or complete shutting off of the gas supply.

Generally accumulation of such condensation in the service line is caused by a sag. The accepted method for correcting such a condition has been to blow compressed air into the line in an effort to push the condensation into the main, where it may be pumped out. But this method is only partially successful and when it fails it is necessary to dig up the line and relay it on the proper grade without a sag so that the condensation will naturally flow into the main. Digging up the line is frequently costly as the sag may be under a concrete walk, curb or road, or beneath shrubbery or trees planted since the line was installed.

But with the use of a new instrument we have developed, practically all cases of condensation in the line can be cleared quickly and without excessive cost. It consists of a rubber washer attached to a small metal ball and a long wire. Pushing the washer through the line by means of the wire pushes the liquid into the main and the washer is pulled back out of the service.

The gas service cleaner consists of rubber washer attached to a small metal ball handled at the end of a long wire.

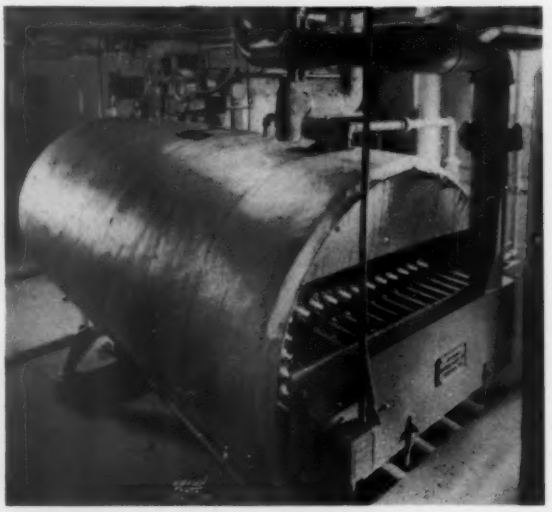
Since condensation collects slowly, the use of this device results in the postponement of digging up and relaying service lines for a long time, thus saving much expense without sacrificing any quality of service.

There is no appreciable amount of gas escaping in cellar when in use, and it is popular with the fitters.

A different sized washer makes the device available for services from 1″ to 2″.

Dessert Maker Finds Gas-Fired Boiler Efficient

by
John E. Hubel



Gas Fired Immersion Type Boiler at Waukesha.

When the time came to put in a new boiler in their modern food processing plant, the Sunlight Dessert Company of Waukesha, Wisc., decided on a Sellers 25 H.P. horizontal gas-fired unit of the immersion type. The engineer on the job claims that he is getting a thermal efficiency of at least 80 per cent from this modern installation.

It is claimed that this type of boiler permits lime and mud to settle to the bottom below the heating tubes. These impurities can then be easily removed in the form of a silt which never hardens. The engineer at the Sunlight Dessert Company plant ascribes some of the high efficiency of the gas-fired boiler to this feature. Also, the combustion inside of the tubes sets up a high mean temperature differential with the water and results in a very rapid heat transfer. The tubes are all located below the water line so that there is not the usual tube corrosion found in vertical boilers.

Recently the gas company made an efficiency test on a 8 H.P. gas-fired boiler of the same type as that installed by the Sunlight Dessert Company. The results of the test are as follows:

Steam pressure at time of test .....100 lbs.
Steam temperature at time of test .....338° F.
B.t.u. input per hour 384,000
Flue heat loss in B.t.u. per cu. ft. gas ..160 B.t.u.
Stack temperature with steam at 100 lbs. .450° F.
B.t.u. utilized per hour 307,200

$$\text{Efficiency} \frac{800 - 160}{800} \times 100 \text{ .....80\% Eff.}$$

Flue gas analysis was:

CO_2—10.0%
O_2—3.0%
CO—.001%

L. S. U. Appoints Edwin L. Dennis

Mr. Edwin L. Dennis, Chief Combustion Engineer, of Coppus Engineering Corporation, Worcester, Mass. since 1939, has been appointed to the faculty of the Louisiana State University, Baton Rouge, La.

Establishing headquarters in Baton Rouge, Mr. Dennis assumed his dual duties beginning February first, retaining his connections with Coppus Engineering Corporation.

Born May 7th, 1900, at Laredo, Texas, Mr. Dennis served in the United States Air Service 1917-1918, attended L. S. U. and received his Bachelor of Science degree, Sugar Engineering, in 1924.

AIR HUMIDITY

Part 2

By

O. J. Kuenhold

Humidification Engr.

Monmouth Products Co.

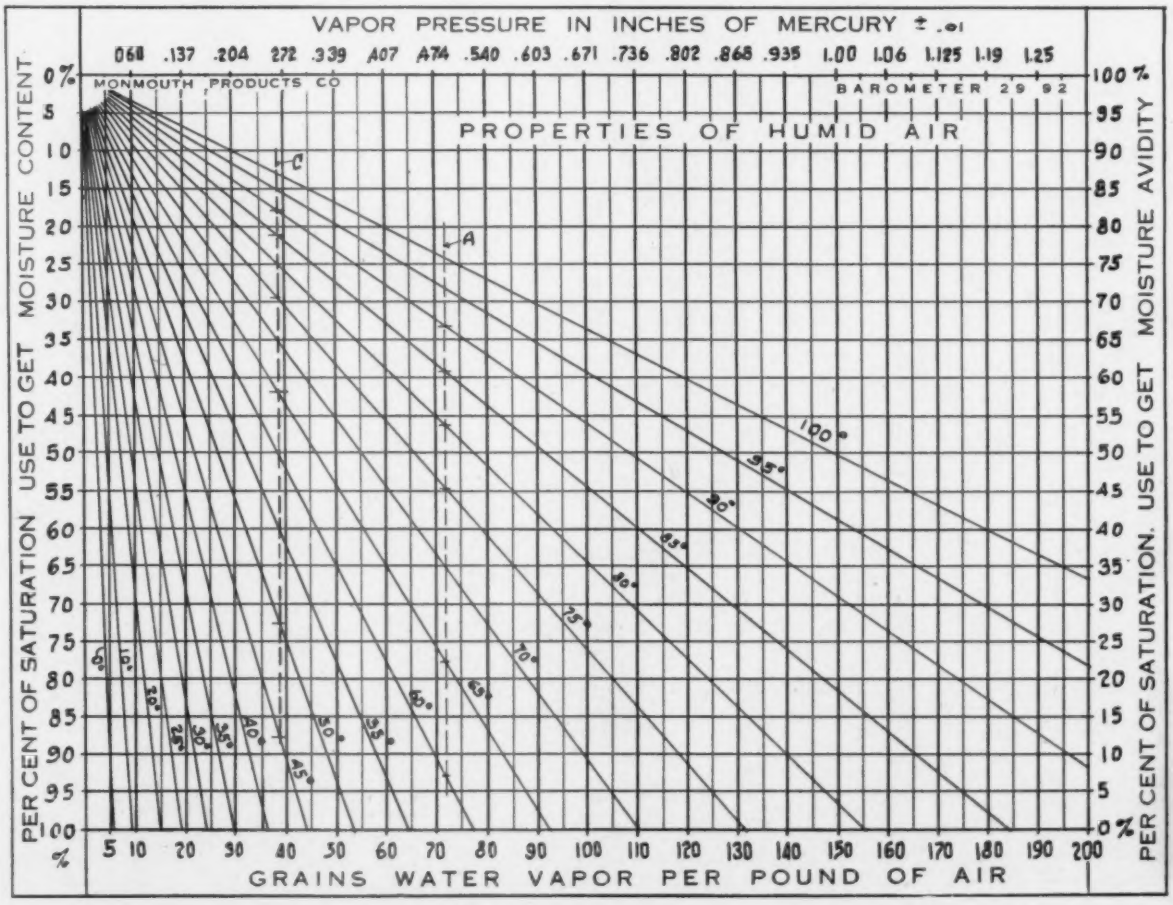
THE preceding article on humidification explained that the term "relative humidity" could more properly be called the "per cent of saturation" because it is merely the ratio between the moisture contained in air to the moisture it could contain if saturated. It was also explained that the moisture absorbing capacity of air is dependent, not on the per cent of saturation (relative humidity) nor on how many grains of moisture the air holds, but on how much *more* moisture it can hold at its temperature. This moisture deficit we call the moisture avidity of the air.

The "moisture avidity" is expressed in grains of moisture per pound of air. It is a direct measurement of the moisture absorbing capacity of the air. To find the moisture avidity of air you must know its per cent of saturation (relative humidity) and its temperature; then by reference to a table or chart you can find its moisture avidity. Chart 2 shows the relationship between air temperature, per cent of saturation, moisture content, moisture avidity and vapor pressure. With it many examples can be worked out, almost at a glance, and a better understanding of air humidity result. To find the moisture avidity or drying capacity of air; find its per cent of saturation at the right. Follow the horizontal line to the left until it intersects the diagonal temperature line and immediately below this find its avidity for moisture in grains per pound of air. Example: At 35% saturation and 70 degrees temperature, the moisture avidity is 72 grains of water vapor per pound.

What per cents of saturation will have the same moisture avidity or equal drying effect at various temperatures? The vertical dotted line "A" represents 72 grains per pound avidity. From this you can see that to have equal breathing comfort with air at 70° and 35% relative humidity, you must raise the humidity to 45% if you heat the room to 75°. Similarly, with 80° room temperature you should humidify up to about 54%. At 85° you must raise the humidity to about 61%. On the other hand if you could feel body comfort at 65° you would have to carry only about 23% humidity to have the moisture avidity of the air equal to that of 70° room temperature and 35% relative humidity.

To find the moisture content of air, find the per cent of saturation of the air at the left. Follow the horizontal line to its intersection with the diagonal temperature line and directly below this find the water vapor content. Example: At 35% saturation and 70°, each pound of air contains 38 grains of water vapor. The vertical dotted line "C" shows the per cents of saturation at which each pound of air contains 38 grains of

CHART 2



moisture, for instance 65° and 42% humidity; 75° and 29%; 80° and 25%.

Table 2 gives the moisture avidity of the indoor air at various room temperatures and during various outdoor temperatures. The moisture avidity given is an average, subject to little variation in below freezing weather or in the higher room temperatures. For example, with the rooms warmed to 70° in 30 degree weather, the moisture avidity of the indoor air will be 91 grains per pound. We may assume that avidity at 70 gives breathing comfort and is therefore healthful, consequently 21 grains of moisture should be added per pound of air.

Now consider the case of rooms heated to 80 in 20° weather. The moisture avidity of the air will then be 143 or more than twice the assumed normal of 70. In zero weather and 85° room temperature the avidity (179) will be more than 2½ times the assumed normal of 70. That is, the membranes of the breathing passages will have to secrete moisture 2½ times as fast as normal. The resulting stifling sensation in breathing would be so strong that few persons could stand it, aside from the bodily discomfort. This explains the origin of the expression "stifling hot." In this the word "stifling" refers to the breathing discomfort and the word "hot" to body discomfort.

Where Table 2 shows avidity above 70, humidification is required. Subtracting 70 from the given avidity tells how many grains of water must be added per pound of air to reduce the avidity to 70. Note that with 65° room temperature, no humidification is required until weather gets below 35. With the usual 70° room temperature, no humidification is ordinarily required until weather gets below 50°; but at 80° room temperature some humidification should be done even in 70° weather and, in 30° weather, three times as much moisture must be added to the air as in 70° weather.

Many people living in inadequately humidified homes cannot sleep well or at all unless they partly open a bedroom window. The stifling feeling is due to the high moisture avidity of the air. When the partially opened window reduces the room temperature, this reduces the capacity of the air for absorbing moisture. The avidity then drops down within the range of breathing comfort and refreshing sleep follows. Suppose for instance the bedroom is at 70°, the weather at 20°. As Table 2 shows, the moisture content of the air will be only 13 grains per cubic foot corresponding to avidity of 98. If the room temperature is reduced to 60°, the avidity will be only 64, which is within the breathing comfort range.

TABLE 2

MOISTURE AVIDITY OF INDOOR AIR

When No Humidifying Is Done.

OUTDOOR AIR			INDOOR TEMPERATURE					
Temp.	Moisture Content	% Saturation	60°	65°	70°	75°	80°	85°
0°	5	93%	72	88	106	125	151	179
10°	8	88%	69	85	103	122	148	176
20°	13	85%	64	80	98	118	143	171
25°	17	83%	60	76	94	114	139	167
30°	20	81%	57	73	91	111	136	164
35°	24	78%	53	69	87	107	132	160
40°	28	77%	49	65	83	103	128	156
50°	39	72%	38	54	72	92	117	145
60°	53	63%	24	40	58	78	105	131
70°	60	54%			51	71	96	124
F	Grains per lb.	AVERAGE	MOISTURE AVIDITY - GRAINS PER LB. AIR					

Opening the window does not materially increase the oxygen content of the air, because normal leakage, especially with an open bedroom door will keep the air pure. A person at rest breathes only 15 cubic feet of air per hour which reduces the oxygen of the air that is breathed by only one-fifth. The oxygen reduction of the air in the room is therefore insignificant. Only a half of a cubic foot of carbon dioxide per hour is added into a room having probably at least 1000 cubic feet, into which at least 350 cubic feet of outdoor air seeps in every hour when windows are closed. The actual fact is that the thing that causes the air in the bedroom to seem so very much fresher when its temperature is reduced even 10 degrees, is that the reduction in air temperature markedly reduces its capacity for absorbing needed moisture from the breathing passages, thus restoring breathing comfort and eliminating the stuffy feeling that is Nature's indicator of an unhealthful condition.

We can now consider what happens to the membranes of the upper breathing passages when air of unduly high moisture avidity is breathed. For thousands of generations humans have lived in Nature's outdoor air in localities where animal and vegetable food existed. In such localities—plains, forests and valleys—there are trees and other plant life. When Nature warms the outdoor air, she also adds moisture to it. Every tree and other vegetation draws moisture from the soil and disseminates it through its leaves. Man has therefore always lived in and breathed Nature's humidified air.

No law of Nature is more thoroughly substantiated than that the organism of plants and animals, such as Man, adapts itself to existing conditions. The breathing mechanism of man, for instance, has, by thousands of generations of living in and breathing Nature's humidified air, adapted itself especially for air having moderate moisture avidity.

In summer, for instance, the air temperature may be in the vicinity of 80° or 85°. It is normally humidified to 55 or 60%. Its moisture avidity is therefore in the vicinity of 70 grains of moisture per pound, or less. Winter air holds nearly all the water vapor it can absorb. Its avidity for absorbing more moisture, while at low temperature, is much less than the usual moisture avidity of summer air.

It is only in comparatively recent generations that man has begun to live in heated and enclosed spaces, such as homes. In heated homes the moisture avidity of the air is much higher than that of outdoor air. Our breathing organism is not adapted to breathe such air. To remedy this we must do as Nature does when She warms the outdoor summer air—we must add moisture to restore to the air the lower avidity for moisture for which our breathing organism is adapted.

The membranes of our upper breathing tracts continuously secrete moisture and, under normal healthful conditions, they remain moist. Their function is to humidify the air to about 100% before it enters the bronchial tubes and lungs. The moistened surfaces also serve to catch dust which otherwise would lodge in the lungs. The moisture can be secreted at a certain rate, but when air is breathed having higher moisture avidity than the avidity for which the breathing organism is adapted, the moistness of the breathing tracts is reduced and a certain stress is created, evidenced in some people by a stuffy feeling, the first warning of an unhealthful condition. There is an instinctive longing to get outdoors to breathe Nature's humidified air. Going outdoors gives immediate relief.

Next let us consider why heated indoor air becomes dry and how dry or avid for moisture, it becomes. All indoor air originates from outdoors by leakage and otherwise. The average weight of water vapor contained in outdoor air varies with its temperature. Table 2 shows how many grains of water vapor each pound of water vapor contains opposite the various weather temperatures listed in the left hand column.

The colder the air is, the less water vapor it can hold. The little water vapor it holds is therefore adequate to give it high humidity and low moisture avidity. When the cold outdoor air seeps into a house it still contains exactly as many grains of water vapor per pound, but when the air is warmed to a higher temperature, its capacity for holding more moisture, and hence its thirst, is greatly increased. The difference between the little water vapor that the air contains and the water vapor it can hold at its higher temperature measures its water absorbing capacity, or moisture avidity.

Other evidences of the influence of moisture avidity upon the breathing passages are:—When you go outdoors into the cold air, which has very low moisture avidity, from warm indoor air having high moisture avidity, one's upper breathing passages become healthfully moist. So little moisture is absorbed by the air that is breathed that there may even be a surplus of moisture secretions—especially in children. If you have a stuffy head cold, note the relief when you go into cool outdoor air, or, put a kettle on the kitchen stove to raise the humidity in the kitchen and note the increased breathing comfort when the air humidity is raised to a proper (not excessive) point. If you suffer from asthma, try this. It gives prompt relief in certain forms of asthma.

If you have a head cold, humidify the air. It brings about healthful breathing conditions that facilitate recovery. There is more sneezing in super dry air. A sneeze is an effort of Nature to re-moisten the breathing passages and possibly ward off an incipient head cold. As humidification tends toward a healthful condition of the breathing passages, it tends to reduce the number of head colds and this explains the common experience of many—less colds.

There are practical limits to how much water vapor the air in homes can carry. These limits must be considered in humidification. They will be discussed in a succeeding article.

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AUTOGAS COMPANY

Review of Late 1940 Gas Company Injury Suits

by
Leo T. Parker
Attorney at Law
Cincinnati, O.

MANY gas company officials believe they are immune to suits filed by injured patrons, pedestrians and others for damages. However, this is not always true. Therefore, the purpose of this article is to review late 1940 higher court cases involving the varied liability for injuries.

First, it is important to know that the law expects gas company officials to exercise reasonable care to know that the company property is not used in a manner likely to be dangerous per se. Also, various higher courts have held that officials and employes of gas companies are charged with a positive obligation to know that the gas company premises, and other places on which work is performed, are reasonably safe for public use.

Avoid Liability

The higher courts in many different cases have rendered decisions on which we may base rules of "how to avoid liability." For example, liability may be avoided by obtaining information, admissions, or statements from an injured person which indicate that the actual cause of the injury did not result from negligence of the gas company officials or employes, but that the injury actually *did* result from want or lack of ordinary care on the part of the injured person to protect himself against the injury. If an admission is obtained that the injured person knew of the existence of the danger, which caused the injury, or that the injured person realized that a dangerous condition was present, then the gas company will not be held liable, because no person is entitled to recover damages from another for any injury sustained as a result of his own negligence. And knowledge of the danger indicates carelessness on the part of the injured person.

In other words, no person is entitled to recover damages for an injury, if the evidence indicates that a reasonably prudent person under the identical circumstances would have exercised such care that the accident would *not* have occurred. This point of the law has been upheld by all higher courts. However, positive evidence on this point must be given, otherwise the gas company will be held liable.

For illustration, in Parsell v. San Diego Consol. Gas & Electric Company, 106 Pac. (2nd) 935, reported December 6, 1940, it was shown that gas company employes, when installing certain gas service for a consumer, dug a trench in the concrete pavement of an alley. The trench was later filled in and the pavement repaired, but there is evidence that after that was done several piles of "stones, broken pieces of concrete, rocks and dirt" were left along the easterly edge of the alley pavement and near a retaining wall along the lot on which the consumer's building stood. These piles of dirt, stones and broken concrete remained there for several weeks after the excavation was filled, and there is evidence that from time to time passing vehicles knocked small rocks and pieces of concrete out onto the pavement.

One day about six o'clock in the evening, a pedestrian, while on her way from her home to a store, entered this alley when she suddenly stepped on a small piece of stone or broken concrete and fell to the pavement, receiving severe injuries.

She filed suit against the gas company and, during the trial, testified that prior to her injury she had passed through this alley at least once a day for many years, that for "quite some time" she had seen these piles of debris near the retaining wall, but that on prior occasions there had never been any stones or broken concrete in her pathway as she walked along the alley.

The counsel for the gas company contended that the pedestrian was negligent and, therefore, not entitled to recover damages from the gas company because she had seen these piles of rock and broken concrete on the edge of the pavement of this alley, and that any danger therein was obvious to her as it must be presumed that she knew that these small rocks or pieces of concrete were daily being moved about over the pavement by passing vehicles, and that it must be held as a matter of law that she was guilty of contributory negligence.

Notwithstanding these contentions the higher court held that the gas company was liable, and said:

"The respondent (gas company) contends that since there was evidence that this injured woman could have proceeded over sidewalks which were safe she must be held guilty of contributory negligence as a matter of law. Reliance is placed upon the case of Buckingham v. Commary-Peterson Company, 39 Cal. App. 154, where the pedestrian was injured while attempting to pass over a highway which was being reconstructed and which was not open to public travel. . . . This alley was open to public travel and it appears from the evidence that it was being regularly used both by vehicles and pedestrians. No warning was given and there was no obvious defect which was known to the injured woman which affected that part of the pavement upon which she was accustomed to travel."

On the other hand, see the leading case of Mora v. Favilla, 186 Cal. 199, where the testimony showed that another safe way existed and the pedestrian was warned that the sidewalk was in a dangerous condition. The court held the pedestrian not entitled to recover damages.

And again in Eldridge v. Clark & Henery Company, 243 P. 43, the court held that when a person uses a street or sidewalk which his observation would inform him is dangerous he takes the risk of such injuries as may result from open and apparent defects which he ought to have seen and avoided.

Jury Considers Facts

When rendering its decision the jury will consider the evidence to de-

termine the facts, as follows: (1) Was the person exercising at least an ordinary degree of care to protect himself from injury when the accident occurred? (2) Was the injured person unfamiliar with the fact that the thing which caused the injury was dangerous? (3) Was the illumination so poor that the average prudent person, under the identical circumstances, would have been injured? (4) Did the gas company officials and employes have knowledge of the defective condition, and if not had the defect existed for so long a period that the gas company employes could have discovered and repaired the defect had they used ordinary and reasonable care?

If, after considering all of the testimony and evidence the jury decides that all of these questions can be answered in the affirmative then it is bound to render a verdict allowing the injured person damages in an amount sufficient to compensate him for (1) the permanent disability which will reduce his ordinary income; (2) the pain suffered; (3) the loss of time; (4) the expenses incurred as a result of the injury; and (5) the loss of income during this period of total disability.

However, if any of the above questions are capable of being answered in the negative, the gas company is *not* liable.

Employes Not Negligent

All higher courts have consistently held that an employe's responsibility is primary. He is responsible because he may have committed the wrongful or negligent act. The employer's responsibility is secondary, in the sense that he has committed no moral wrong, but under the law is held accountable for his agent's conduct. While both may be sued in a single action, a verdict exonerating the agent must necessarily exonerate the principal, since the verdict exonerating the agent is a declaration that he has committed no wrong, and the principal cannot be responsible for the agent if the agent has committed no tort. Therefore, if the evidence indicates that a gas company's employe, whose acts affected an injury, was not negligent then, under these circumstances, the gas company is not liable. This same rule of law is applicable to contractors employed by either a city or gas company.

For example, in Jentick v. Pacific Gas & Electric Co. 105 Pac. (2nd) 1005, reported November 1, 1940, it was disclosed that an accident happened at the time a City and County were engaged in widening an avenue. The testimony showed that the gas company maintains pipes and conduits in the avenue and supplies the residences on each side with gas. The contractor employed by the city, when using equipment and machinery to dig up the pavement of the street, severed a gas line. This resulted in an explosion which seriously injured a gas consumer. The latter sued the gas company to recover damages and alleged that the gas company employes (1) should have discovered the break in the service pipe and either repaired it or shut off the gas in time to prevent the explosion; (2) that the gas company employes should have immediately shut off the gas before the contractor started to do his work; and (3) that the gas company employes should have removed the service pipes serving the residences. Also, it was contended that the gas company officials were negligent in failing to file with city engineer a map showing the location of gas pipes as required by the city and county ordinances.

Notwithstanding these contentions the higher court refused to hold the gas company liable, and said:

"There is no evidence that at any time the contractor, either personally or by agent, applied to the city engineer or any other officer or employe in the city government to be allowed to inspect a map or to obtain a copy of a map of the location of the pipes in Nineteenth avenue. It follows the filing or non-filing of said maps was not a proximate cause of the accident. . . . Again the plaintiff (injured person) contended the service pipe was negligently installed and maintained. In this connection they rely on the evidence that said pipe was but a few inches beneath the pavement of the street. There was no evidence that such installation or mainenance was negligent. . . . A most careful examination does not disclose any want of care on the part of any person employed by the defendant (gas company) except the individuals who were in charge of the job and who were by the verdict of the jury acquitted of negligence."

Owner Obligated

Various higher courts have held that where an appliance for heating water by gas, on private premises, is owned and controlled by the owner or occupant of the premises, a gas company which did not sell or install the appliance, but which merely furnished gas to it, is not responsible for the condition of the appliance, and is not liable to the owner or occupant for injuries caused by its defective condition, unless the gas is supplied by the company, with actual knowledge on its part of the defective and dangerous condition of the appliance.

For instance, in Cornett v. Georgia Public Utilities Company, 11 S. E. (2nd) 68, reported November 21, 1940, it was disclosed that a tenant rented a building and authorized a gas company employee to turn on gas. A gas water-heater and the pipes and vents connected therewith were not installed by the gas company but had been installed by the owner of the building long before the tenant moved into the premises. Moreover, the heater and equipment had been used for several years by former occupants, and appeared to be in good condition and was continued to be used by the tenant without giving any trouble whatever for some five months, before the incident complained of occurred.

One day the tenant used the gas water-heater in heating water to take a bath; and while bathing she was overcome and rendered unconscious for several hours, as a result of inhaling carbon monoxide and kindred gases which had escaped from the gas water-heater into the atmosphere of the bathroom. She sued the gas company, and alleged that the gas company employes were negligent in not providing proper vent pipes and vents for the escape of the carbon monoxide and other gases to the outside of the dwelling, before turning on the gas. Also, she alleged that the company officials were negligent because when the employes turned the gas on in the house the pipes were rusty, filled with leaves, debris, and decay, and were unfit for use.

It is important to know that the higher court refused to hold the gas company liable, and said:

"Under the allegations of the petition there was no duty on the defendant (gas company) to inspect the gas water-heater and pipes and vents connected therewith, as they were owned and controlled by the owner of the building or the occupant thereof, and not by the defendant."

M. P. Robinson Joins Worthington

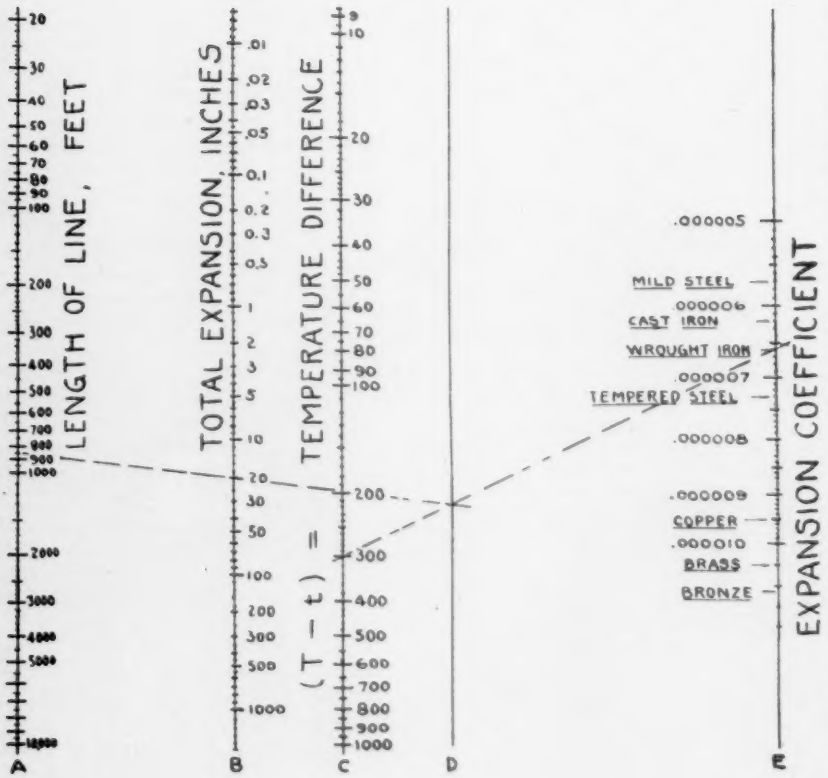
M. P. Robinson, proprietor of the Robinson Filter Company, has joined the Worthington Pump and Machinery Corporation organization to take charge of that corporation's newly organized water purification equipment division. Prior to the establishment of his own water purification company in 1937 Robinson had, for seventeen years, been eastern representative of the International Filter Company of Chicago.

He is a licensed professional engineer under authority of the State of New Jersey.

Two Engineering Aids

By
W. F. Schaphorst, M.E.
Newark, N. J.

A Useful Expansion Chart



This chart tells, in a quick and simple manner, the number of inches expansion in any metal from mild steel to bronze. It handles any length of any metal, from 20 ft. to 10,000 ft., (see Column A).

For example, How much will 850 ft. of wrought iron pipe expand where the temperature is 300 degrees F.?

Connect the 300, (Column C) with the coefficient of expansion of wrought iron (Column E) and locate the intersection with Column D. Then, from that point of intersection run over to 850 (Column A) and the expansion is found to be 20 inches (Column B).

So, all one has to do is to lay a straight edge across the chart a couple of times and the total expansion in inches is determined without bothering one whit with the decimal point. If you haven't a straight edge use a thread, a straight piece of paper, or anything else that is convenient and that happens to be straight.

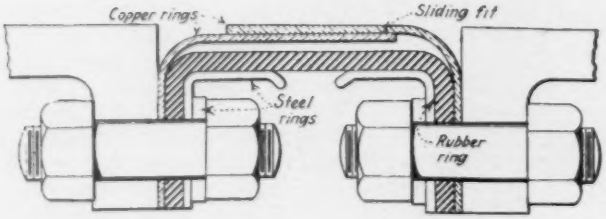
It will be noted that this chart can be used for "any material" having a coefficient of expansion between .000005 and .000012.

The coefficients of the principal metals that fall between those limits are indicated on the chart.

The temperature difference (T—t) is found by subtracting the minimum temperature from the maximum. Thus a steam pipe at its coldest may be 40 deg. F. At its hottest it may be 740 deg. F. The difference is therefore 740 deg. — 40 deg. = 700 deg. F.

Home-Made Water-Tight Expansion Joint

Gas plant executives will doubtless be interested in this "home-made" expansion joint designed by a large Eastern engineering concern. It was designed in order to solve an expansion joint trouble. The joint was made leak-proof by means of a rubber ring, as shown in the accompanying sketch. The joint is strong laterally because of the two telescoping copper rings which makes it possible for the joint to withstand considerable pressure. A joint of this kind is excellent for handling water and other fluids that will not attack the rubber. It cannot be used for high-temperature steam or water, as the rubber deteriorates under excessive heat. Nor can it be used for handling oil because rubber dissolves in oil.



Selling Gas Heat in the Nation's Capital

By

A. J. Maloney

General Sales Manager
Washington Gas Light Co.

WASHINGTON is a rich market. In the considered opinion of many experts, Washington has been, is and will continue to be one of the richest markets in America. Necessarily this rich market has attracted to it many large, aggressive appliance merchandisers.

The automatic heating field has been no exception. There are well over 100 oil burner manufacturers operating in the Washington area. Despite this highly competitive condition, there have been installed as of the first of December, 1940, slightly over 24,000 central gas heating units, 10,000 of which were installed in the replacement or retail market and the remaining 14,000 in the new construction field.

In the interest of clarity and brevity, I am going to break down the story of gas house heating in the Nation's Capital into three comprehensive parts.

1—Retail or replacement market
2—The new construction market
3—Our dealer allies

Gas house heating made its debut in Washington during 1923 when 25 gas units were installed. Previous to this time there were no more than six homes in the area heated by gas. During the seven years 1923-1930, 619 units were added, so that on August 1, 1930 there were 650 homes heated by gas. The gas house heating rate was $1.00 per MCF for 600 B.t.u. gas.

In September, 1930, a reduced rate of $.60 per MCF, plus a graduated demand charge was inaugurated for house heating. The B.t.u. content of the gas remained the same.

Retail salesmen were hired for a city-wide campaign. They were trained in one week to calculate heat losses, figure radiation, properly size equipment, and to estimate the season's operating cost for the customer.

(Delivered at the Pennsylvania Gas Association's Mid Year Sales Conference, January 9, 1941.)

An extensive advertising campaign through the newspapers acquainted the Washington public with this progressive venture and extolled the virtues of gas for house heating. No longer was gas house heating a luxury. No longer was the cost of equipment prohibitive. Not only had the rate been reduced so as to be on a competitive basis, but a conversion burner, complete with thermostat, could be installed for less than $200.00.

Oil or coal, in case the customer had any, was removed from the premises and credited to the customer's gas account at the full retail value Terms could be had up to 36 months. Contracts were accepted with no down payment. Generous allowances were made for old coal furnaces, and even more generous allowances were made for oil burners. There was no carrying charge.

Securing Leads

Salesmen selling other appliances in the Company, and all other non-selling employees who contacted the public were instructed to seek house heating prospects Naturally, a sale from such a lead paid a basing commission to the individual turning in the prospect.

From all of these various sources thousands of prospects were obtained. During this campaign which ran from October 1 to December 31, 1700 gas house heating units were installed.

Difficulties Met

In the spring of 1931 there was plenty of trouble. Some of the salesmen either had not learned how to calculate heat losses and make proper heating estimates, or else they had learned too well and had taken unfair advantage of a lucrative situation.

Many jobs had to be altered, many had to be changed, and still many more were removed. Incidentally a number of the 40 salesmen who made up the first retail organization were likewise removed. Needless to say this situation gave gas house heating in Washington a "black eye."

To avoid a repeat performance of the undesirable results of the first campaign, the Utilization or Engineering Department was established. Work sheets were supplied the salesmen and each job was checked and figured by a competent engineer before the sale could be consummated. In addition, the estimate was reduced to letter form and mailed to the customer independent of the salesmen. This sobered the activity of the salesmen in the field, and instilled confidence in the customer. Customers who were complaining were contacted by Gas Company salesmen, who, whenever possible, advised the installation of weatherstripping, insulation, and storm sash. Likewise, prospects were advised to insulate, weatherstrip and otherwise effect conditions that would reduce the estimate as well as the operating cost.

This group operated as a heating division until 1933. Units were being added to the lines at the rate of about 1,200 per year.

Departments Reorganized

A reorganization was effected early in 1933 which threw the refrigeration and heating appliances into one division and the cooking and water heating appliances into another division. This came about as a result of a change in Company policy and it entailed the absorption of several small groups of specialty men. The program that followed

provided a heating campaign in the early spring and fall, with emphasis placed on refrigeration during the summer months. This arrangement continued in effect until 1938 when water heating and house heating, the basement appliances, were combined in one division and cooking and refrigeration, the kitchen appliances, made up the other.

During the years the heating division has been strictly retail. Territories have been devised and allocated to the men. They have been revised from time-to-time so that the potential in one territory compares favorably with the others

Every major sales job accomplished has been during a spring or fall campaign period with special emphasis placed on quota. These campaigns have been dramatized, are usually introduced at a dinner meeting, and are designed to encourage concentrated effort from the men. Prizes and bonuses have always been found a most efficient factor in obtaining the best results. Naturally, a campaign without advertising, showmanship, and dramatization is like a guy winking at a girl in the dark—"you get no results."

Surveys and Advertising

A city-wide market survey was worked out and a Kardex file made of every home in Washington with a complete record of all four appliances; namely, cooking, refrigeration, water heating, and house heating. A daily rotation of prospect cards to the retail salesmen by the supervisor keeps the file up-to-date and constitutes a daily assignment for the men. Direct mail, sent regularly to potential customers, in addition to the salesmen's calls, keeps up a good prospect contact.

This direct mail may be the piece of one manufacturer, or it may be a piece designed by the Advertising Department. If the salesman indicates a customer preference, then that preference, of course, is followed.

A list of users in the hands of each salesman citing the actual season's operating cost for the past three seasons, the estimated cost, and the actual radiation has proved a most valuable sales tool.

With this masterpiece, the retail salesman can answer all questions about the job that reputedly ran $100 per month last year. Likewise, he can compare the season's operating cost to the estimate. This procedure without question removes prejudice, argument and fear on the part of the potential customer.

A budget plan whereby the estimate can be divided into eight equal installments, has been a great help in overcoming prejudice against the higher bills for the colder months.

A little book, "How You Can Save House Heating Dollars," is sent to each new customer as soon as the heating meter order is received.

Operating Manual

This past summer a new service was inaugurated. A manual, explaining the starting-stopping and operating instructions, was developed for the various models of furnaces and boilers on the Company's lines. Men were hired and trained to discuss and explain the manual. This service met with unusual acceptance and at the same time broadened our ability to service house heating equipment more quickly.

This brings us to the end of the first phase of the story of gas house heating in Washington. One of the most important factors in this end of the business has been the training, directing and compensating of our retail door-to-door salesmen. Too much emphasis cannot be placed on the fact that to promote and sell a so-called luxury appliance such as automatic heating, you must hire and train high class retail salesmen, and compensate them accordingly.

Wholesale Department

A year after the rate reduction for house heating, the wholesale department was organized. The five salesmen who comprised this department in October, 1931, did not find the sale of gas for house heating an easy task. For two years their efforts were largely missionary. Finally after talking to builders about furring walls, insulation, and weatherstripping, their efforts were rewarded. The four-family flat made its appearance and with it came the first large wholesale order for gas house heating boilers. A small gas boiler was located in the kitchen along with the range and water heater, thus eliminating the necessity for a basement. This saved money in construction, curtailed janitor service, and allowed each tenant to select any desired room temperature

The next progressive step by the Wholesale Dept. was in the row and semi-detached house. Capitalizing on the recreation room in the basement, some builders began using gas boilers in order to create more space in the basement. By the end of 1935 the Wholesale Department had done a fair job of missionary work and had secured the installation of approximately 1,300 gas boilers for house heating. In December, 1935, there was an elimination of the demand charge in the house heating rate. This, in addition to the increased building activity in Washington called for a change of Company policy. So, early in 1936 the Promotional Department supplanted the former Wholesale Department, personnel was increased to 14 men and a supervisor along with sufficient clerical help. These men contact every new construction job in the area. Some men have "special" accounts—builders whom they have known over a period of years, others cover a given area or territory.

Winter Air Conditioner

The year 1936 saw the introduction and active promotion of the forced warm air unit, better known as the "Winter Air Conditioner." From approximately 100 air units in 1936, this particular unit has grown in acceptance so that for the year ending December 31, 1940, more than 2,000 such gas fired "winter air conditioning units" were installed.

Gas fired "winter air conditioning" was a problem child for the Gas Company during 1936, 1937 and well into 1938. Practically every plumber and heating contractor was familiar with hot water, steam, and vapor-gas fired, but no one was too familiar with the air systems.

Cooperative Work

The Engineering and Sales Departments worked with the manufacturer, with the distributor and with the installer. Minimum installation standards were devised and advocated by the Gas Company. Mistakes were corrected wherever possible and the Gas Company exerted every influence to prohibit a recurrence of the same mistake. It took a lot of patience, tireless effort, and unstinted unselfishness to arrive at an understanding with equipment manufacturers, distributors and installers where all agreed that the heating unit cannot be divorced from the system of ducts to which it is attached. But that understanding has been reached and is being exercised in Washington, today.

Productive Market

No longer is gas house heating considered for just the flat, the row house, and the small detached home. Today, some of the largest homes and estates in Washington are using

Do you want to sell more women on gas? . . . sell more of your better ranges?

NOTHING OFFERS the housewife more convincing proof that "Gas does it best" than a demonstration of the Harper Burner System. For this reason, we strongly recommend that at least one Harper-equipped range be connected to gas on every sales floor.

Point by point, you can then forcefully illustrate its many advantages . . . unmatched by any other cooking unit. You are not confined to mere words.

Your customers see for themselves the unique Harper principle of "2 burners in 1"... both controlled by the same handle. They can check for themselves the time-saving speed of the STARTING BURNER . . . the exact and unvarying boiling heat of the tiny COOKING BURNER. They can see how the COOKING BURNER operates independently of the STARTING BURNER . . . can be regulated to just the right heat for every cooking requirement.

Once your customers have seen the Harper Burner System in action, much of your selling has been effectively accomplished. They are "sold" on the speed, convenience and economy of the modern gas range . . . the unmatched efficiency of gas as a fuel.

THE WORLD'S FINEST TOP BURNERS

...one of the standards of top burner performance under cp

THE HARPER BURNER SYSTEM

"2-burners-in-1"

STARTING BURNER, utilizing inside and outside rings of ports, brings foods quickly to a boil.

COOKING BURNER, employing only the small inside ring of ports, maintains the cooking after the boiling point has been reached.

4/5 of the cooking is done on top of the range. Therefore, a range which has the finest top burner made, sells the housewife . . . especially when you demonstrate it to her and she sees its simple operation and advantages.

The Harper Burner System is a patented invention which makes each burner on the range "2 burners in 1" . . . a burner within a burner . . . both operated by the same handle.

This arrangement affords a high-speed STARTING BURNER to start foods boiling . . . plus a small, central, economical COOKING BURNER for maintaining foods at exact boiling heat. The COOKING BURNER operates entirely independently of the STARTING BURNER, and, in addition to its measured boiling temperature, can be turned to any other *lower* cooking heat.

No other burner possesses this vital advantage: easy, accurate control—the right heat for every type of top burner cooking . . . every time.

HARPER BURNER SYSTEM

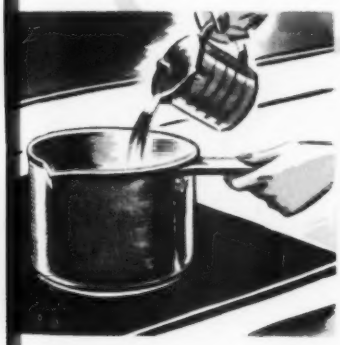
Diagram shows how the COOKING BURNER operates independently of the STARTING BURNER, Yet both are controlled by the same handle.

Copr. 1941, Harper-Wyman Co.

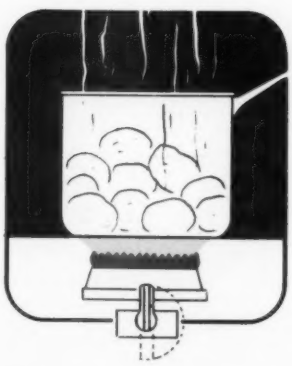
Your customers easily understand these *advantages* when they see the HARPER BURNER SYSTEM *in action*

The Harper Burner System offers the housewife more advantages than any top burner in history . . . a new speed in cooking, a new convenience in cooking, new savings in cooking time as well as great savings in money.

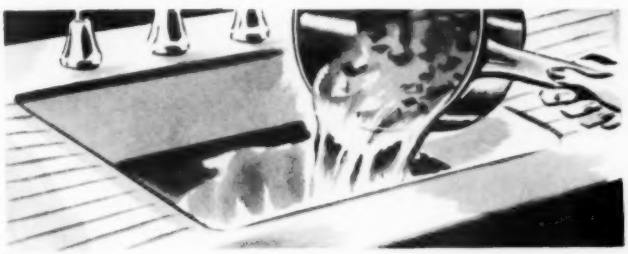
These advantages are brought home to her forcefully and convincingly when she actually sees the modern system of flame control which makes them possible. Connect the Harper Burner System to gas! Prove its benefits!



1. SAVES COOKING TIME With the Harper Burner System, it is only necessary to use a *single cup of water*, as compared with the *quarts* which many women feel are necessary with ordinary, inaccurately controlled burners. Two quarts of water take 12 minutes to bring to a boil. A cupful takes less than 2 minutes.



2. SAVES MONEY The Harper Burner System saves up to 39% in fuel consumption. Heat is directed only to the bottom of the vessel, where needed. It is not wasted up around the sides. The small COOKING BURNER maintains cooking with the minimum of gas.



3. SAVES VITAMINS Many valuable minerals and vitamins in foods are simply poured down the drain in the excess water used in cooking. The Harper Burner System requires *so little water* that these vital food elements are retained in the food.

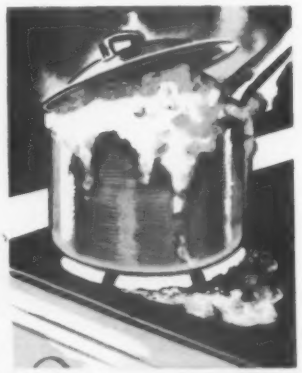
4. COOLER KITCHEN The controlled cooking heat of the Harper COOKING BURNER keeps kitchens as much as 9 degrees cooler, by actual test. This advantage is even more important a feature than insulated ovens, for ovens are used only part of the time; top burners are used for almost every meal. (*Please turn page.*)

5. "ABSENT COOKING"

The Harper COOKING BURNER is so accurately adjusted that it always takes more than an hour to boil away a single cupful of water in a covered vessel. The housewife, then, need only see that she uses one cup of water for every hour she plans to be absent from the kitchen. The average woman saves 8½ hours of unnecessary pot watching *each week*.

6. NO BOIL-OVERS

The Harper COOKING BURNER keeps the contents of a covered vessel at exact boiling temperature—212 degrees . . . and takes more than an hour to boil away a single cupful. A larger flame would only waste fuel or cause boil-overs or boiling dry.

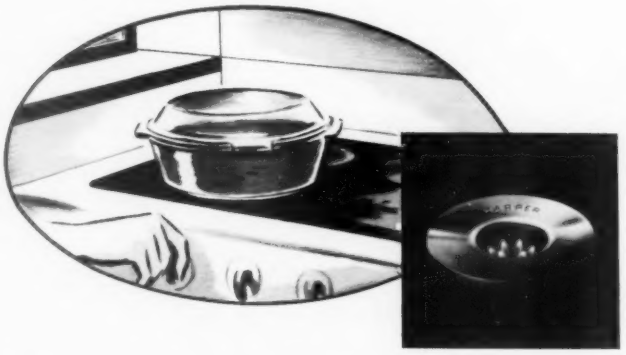


7. FOOD TASTES, LOOKS BETTER

Unless vegetables are "boiled gently" they become soggy and tasteless. They are literally "boiled apart". The smaller amount of water required by the Harper COOKING BURNER and its exactly controlled heat, saves the flavor of foods, makes them more attractive when served.

8. NO DOUBLE-BOILER NEEDED

With ordinary burners, most women feel they need a double-boiler as a safeguard against burning cereal, cream sauces, etc. The controlled heat of the Harper COOKING BURNER permits direct-flame cooking. No expensive utensils are needed.



9. REAL "KEEP-WARM" HEAT

When turned low, the Harper COOKING BURNER will keep the contents of a covered vessel at about 170 degrees—the ideal serving temperature. This cannot be done with ordinary top burners. As each food finishes cooking, the COOKING BURNER is simply turned to "keep-warm" heat. All foods may be started at one time. Those finished first safely await the others with no danger of over-cooking.

THE HARPER BURNER SYSTEM

now featured in the ranges of 28 leading manufacturers

—one of the standards of top burner performance under Cp

HARPER-WYMAN COMPANY, 8562 Vincennes Avenue, Chicago

gas house heating. This is true in the retail as well as the new construction markets. People who live in gas heated flats invariably select gas for heating when building or purchasing a new home.

There are many reasons why one family in every six in Washington uses gas for house heating today. The vast majority of people in Washington work for the Government. In many instances husband and wife both work. The flexibility and the many advantages of gas house heating have a definite appeal to them.

The row house in Washington readily lends itself to gas house heating. Regardless of whether it is old or new, there is a growing tendency to utilize the basement by establishing a recreation room, playroom for the youngsters, or a suitable place for laundry work. Since the users of gas house heating embrace the lower income brackets as well as the higher ones in Washington, all these appeals are paramount.

The Gas Company has emphasized the economy of gas house heating in the broader sense. When selling a new prospect, figures are based on a ten year period. People have begun to realize, after ten years, that such predications are correct.

There's the story of the installation of 14,000 units in the new construction market. Our progress in this field has been a healthy one. For the year 1940 we secured 59% of the automatic heating business in the important new construction market. We have found that this new construction business has a favorable effect on retail sales because as new construction goes, so goes the replacement business.

Dealers As Allies

Now the third and final phase of the story of gas heating in Washington—the part our dealer allies played in the installation of these 24,000 units. In the initial promotion and missionary period for gas heating, the plumbers, heating contractors, and jobbers were of little value to us despite the fact that promotional efforts were directed towards them.

Today, however, after years of working with these groups we find them invaluable allies and they play an increasingly important part in the sale of automatic gas heat in Washington. When public acceptance is created for gas house heating, the appliance dealer is indispensable if you wish to insure the retention of that public acceptance at the lowest possible cost to the Utility. After all the missionary work for the fuel acceptance is our business—the sale of the merchandise is eventually the dealer or local merchant's business. The case is well illustrated by what the old African Trader said to the Missionary, "It's your job to convert the heathens and I'll sell the bibles."

In conclusion these 14,000 units installed in the new construction market plus the 10,000 installed in the replacement market give us a total of over 24,000 central gas heating units, or a saturation of 17%.

This job has been accomplished, we believe, by the coordination of three important factors. These three factors are effective advertising, well trained salesmen, and dealer cooperation. When asked which of the three is the most important, I am reminded of the story told of Andrew Carnegie. Once when asked which of the three elements of business he considered the most important—Production — Finance—or Selling — he replied by asking the question, which is the most important leg on a three-legged stool.

Montreal Experiences Increase in Revenues,—and Taxes

John S. Norris, president of Montreal Light, Heat & Power Consolidated, at the company's annual meeting on February 19th, announced the appointment to the board of directors of Morris W. Wilson, president of the Royal Bank of Canada, and of Alfred H. Paradis, well-known industrialist. He revealed that since 1932 the company through refunding operations had achieved a saving of $1,000,000 a year in fixed charges and pointed out that, as part of the company's contribution to the war effort, nearly 25 cents of every dollar of gross revenue received now goes out to the tax collector.

The company's tax bill is equivalent to nearly one-quarter of its gross revenue—in other words, for every dollar the company collects for gas and electricity nearly twenty-five cents goes to the tax collector. The increase for the year ($2,101,550.00) amounted to more than the total taxes for the year 1934 and it is to be hoped that the rising trend will reverse itself after the war needs have been met.

Mr. Norris stated that the past year had been one of the most strenuous and active in the company's history, due to the sharp increase in power requirements from industries occupied with war contracts. Wartime conditions had created new operating difficulties, and added to tax and other expense burdens.

REED'S 4 WHEEL
Razor Blade Pipe Cutters

IDEAL FOR ANY TRENCH OR OTHER CLOSE QUARTER JOBS

$4.67 F. O. B. ERIE

Capacity
½" to 2"
Weight 5 lbs.

The REED FOUR WHEEL Cutter operates with a short back and forth motion through only one-third of a circle. Each of the four wheels exerts the same pressure on the pipe, and all 4 therefore cut evenly and completely through the pipe at the same time.

Equipped with Reed special alloy RAZOR BLADE Wheels, which cut with remarkable ease, leave little burr, and have a long life of useful service.

A sample cutter for test and trial may be ordered on memorandum invoice, to be paid for if retained or returned for credit if unsatisfactory. Try it once, and you will use no other.

REED MFG. COMPANY
1436 W. 8th Street • ERIE, PA.

Secure MAXIMUM EFFICIENCY THROUGH REYNOLDS COORDINATED Gas Control

The necessity of maximum Efficiency in Gas Control with the new complex installations of modern heating equipment is easily achieved with REYNOLDS Regulators. All Reynolds Regulators from the big ton capacity giant down to small low pressure inches W. C., are carefully coordinated and tuned to function together. There is a Reynolds Regulator especially designed for every Gas Control need.

Long Life—Efficient Operation—Accurate Regulation—Reasonable Cost—Low Upkeep—all of these vital features are inherent with REYNOLDS REGULATORS.

For full cooperation of our Engineering Department, Write our Factory, Branch Offices or Representatives.

REYNOLDS PRODUCTS

High Pressure Service House Regulators: Straight Lever Type—Models 10-20 Series. Toggle Lever Type—Model 30 Series.

Low Pressure Service or Appliance Regulators.

District Station Regulators. Single or Double Valve. Auxiliary Bowl and Automatic Loading Device Optional.

High Pressure Line Regulators—Pilot Loaded—Pilot Controlled.

Toggle Type Regulators. Single Valve. Double Valve. Triple Outlet.

Seals: Dead Weight or Mercury.

Relief Valves: High or Low Pressure.

Back Pressure Valves. Automatic Quick-Closing Anti-Vacuum Valves.

Automatic Shut-Off Valves.

Lever Operated Valves.

Louver Operated Device.

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No. 268 Park St.
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Gas control Since 1892

REYNOLDS GAS REGULATOR CO.
ANDERSON, INDIANA, U. S. A.

MAXIMUM Activity Capacity!

LAVINO "ACTIVATED" OXIDES

LAVINO *activated* OXIDE

Supplied in unmixed form . . . ready for mixing with your own carrier . . . LAVINO "ACTIVATED" OXIDE is readily adaptable to the needs of your plant, whatever its size or requirements.

Not merely a "satisfactory" purifying medium by virtue of incidental properties, it is a material made specifically for maximum H_2S removal. As such, its practical capacity and activity are controlled factors. And, it offers maximum activity for trace removal and maximum shock resistance. Contains 70% Fe_2O_3 as received; approximately 10% moisture.

LAVINO *activated* SPONGE

is furnished ready mixed, carefully coated on large, tough, specially selected hardwood shavings.

BOTH Lavino Activated Oxides are disinfected by an exclusive process to minimize formation of mold or other fungous growth. AMERICAN MADE, they are available for prompt shipment.

LESS OXIDE REMOVES MORE H_2S!

E. J. LAVINO and COMPANY
1528 Walnut St., Phila., Pa.

Flow of Gas Through Pipe Lines

By

R. Vittinghoff

Pure Oil Company, Beaumont, Texas.

and

H. Vittinghoff

Stone & Webster Engineering Corporation, New York, N. Y.

IN TRYING to determine whether a pipe line of given length and diameter could transmit a specified quantity of gas per hour it developed that when the initial pressure was 800 lb. per square inch the terminal pressure would be either 350 lb., 250 lb., or even less than atmospheric pressure, depending upon which of several well-known formulae was used. These startling discrepancies caused the authors to review at length the published information on pipe line flow. The results of this study are submitted herein to those interested in problems of this nature.

For determining the carrying capacity of a pipe line or for computing the pressure loss experienced when carrying a given quantity of gas through a pipe line of specified dimensions there are available a great number of different formulae which in most cases, when all is said and done, come down to certain general equations.

$$Q = 1.6156 \frac{T_o}{P_o} \left[\frac{(P_1^2 - P_2^2)\, d^5}{GTLf} \right]^{1/2} \quad \text{(Ia)}$$

or

$$Q^2 = 2.6102 \frac{T_o^2}{P_o^2} \left[\frac{(P_1^2 - P_2^2)\, d^5}{GTLf} \right]$$

and

$$\frac{Q^2 P_o^2 GTLf}{T_o^2 d^5 \times 2.6102} = P_1^2 - P_2^2 \quad \text{(IIa)}$$

Where:—

Q = Cu. ft. of gas per hour at 60° and 14.7 lb. absolute
T_o = Base Temperature °F. absolute
T = Temperature of flowing gas absolute
P_o = Base Pressure lb. per sq. inch absolute
P_1 = Initial Pressure lb. per sq. inch absolute
P_2 = Terminal Pressure lb. per sq. inch absolute
d = Diameter of pipe — internal — inches
G = Spec. Grav. of Gas relative to air at 60° —14.7 lbs.
L = Length of line—miles
f = Coefficient of friction

If standard conditions are assumed where:—

T_o = 60° F. = 520° F. absolute
P_o = 14.7 lb. per sq. in. absolute

The basic equations will then read:

$$Q = 1.6156 \times \frac{520}{14.7} \left[\frac{(P_1^2 - P_2^2)\, d^5}{GTLf} \right]^{1/2}$$

$$Q = 57.1505 \left[\frac{(P_1^2 - P_2^2)\, d^5}{GTLf} \right]^{1/2} \quad \text{(I)}$$

and

$$P_1^2 - P_2^2 = \frac{(14.7)^2\, Q^2 GTLf}{(520)^2 \times 2.6102 \times d^5}$$

or

$$P_1^2 - P_2^2 = 0.00030616 \frac{Q^2 GTLf}{d^5} \quad \text{(II)}$$

These equations, it will be noted, include the term "f" or friction factor and, generally speaking, the variations in form or appearance noted among the multiplicity of different flow formulae depend upon the values assigned to "f" by the several authors of the formulae. Analyzing the various values of "f" as given, it appears that different authors have estimated this friction factor as varying more than one hundred percent even for comparable pipe sizes and rates of flow. Furthermore, it appears that most of these formulae were developed in the laboratory while working on pipes of small diameters under relatively low pressures and of limited length, and the friction factors so determined were then considered as applicable to large pipes many miles in length.

The Bureau of Mines, in co-operation with the American Gas Association, carried out a number of field tests on commercial pipe lines. Having determined both the quantities and pressure drops, and knowing the temperatures, specific gravities and viscosities of the various gases handled, the known data were applied to certain specific flow formulae to compute the friction factor "f," which was the unknown and controlling element governing conditions of flow. This friction factor as so computed showed large variations from the values of the factor as assigned in the formulae. In the present discussion an effort has been made to arrive at the mean value of the friction factor, taking into account that in actual practice with large pipe lines it will probably vary to a much smaller extent with increasing Reynolds' numbers than has been assumed in assigning numerical values to "f" in the several published formulae. It is judged that under the conditions as to pipe line sizes and quantities handled in natural gas transmission practice this friction factor may be determined by the following formula:

$$f = 0.0029 + \frac{4.2365}{R_e^{0.661}} \quad \text{(III)}$$

This equation is submitted in graphic form on the accompanying chart.

In order to illustrate the application of the formulae to a specific problem we will assume that the following conditions prevail:

Q = 24,000,000 cu. ft. per day = 1,000,000 cu. ft. per hour.
G = 0.625
T = 80° F. or 540° absolute
L = 36 miles
d = 8.071 in.

It is first necessary to find the Reynolds' Number, R_e and f

$$R_e = \frac{D\,U\,S}{\mu} \quad \text{(IV)}$$

Where:—

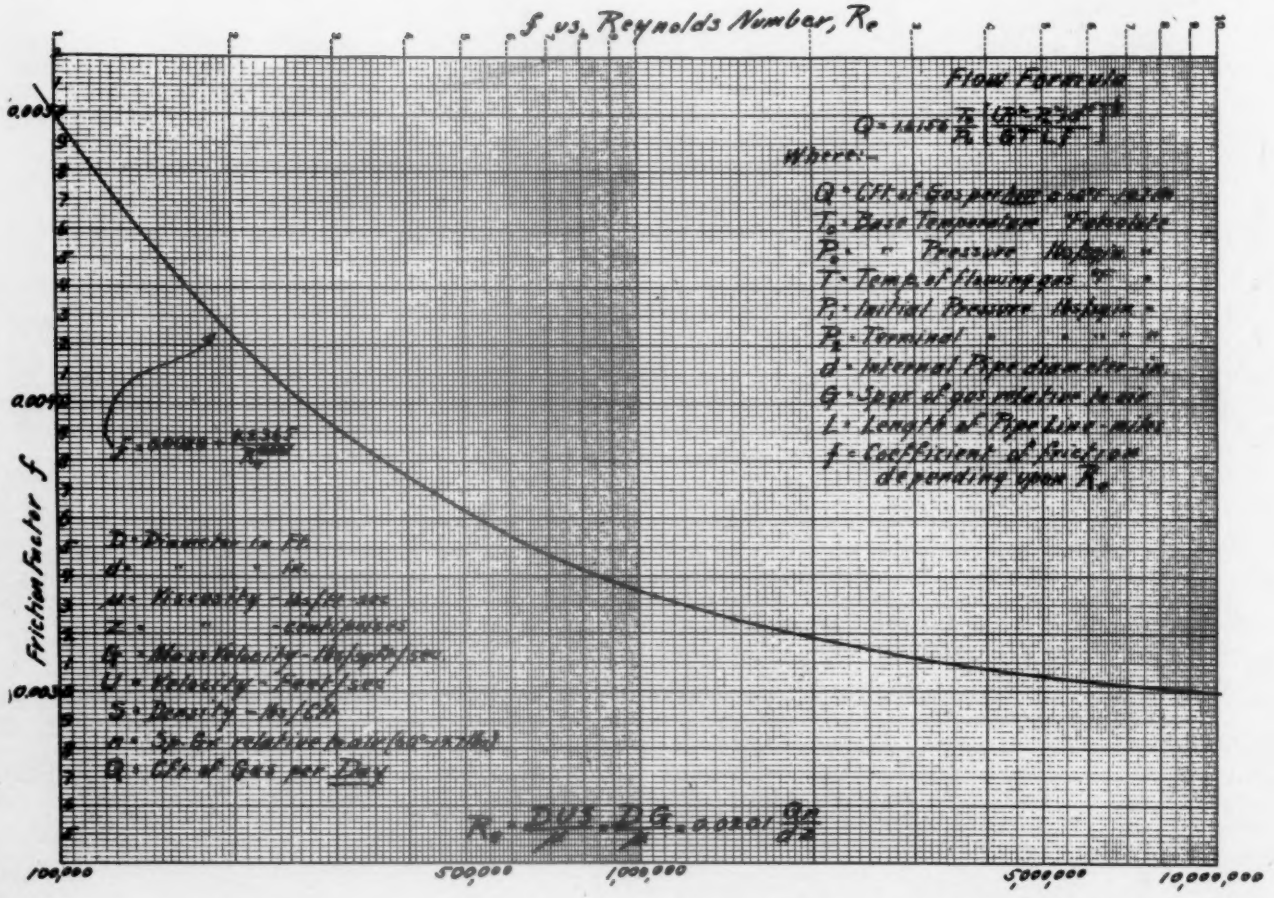
D = Diameter in feet = $\frac{8.071}{12}$ = *0.673 ft. = D*

U = Velocity in feet per second = $\frac{Q}{3600 \times \text{Area}} = \frac{1{,}000{,}000}{3600 \times 0.3562}$ = *780 feet per second = U*

S = Density of Gas in lb. per cu. ft. Air weighs 0.07655 lb. per cu. ft. × 0.625 = *0.0478 lb = S.*

The viscosity, μ, of gas of the composition indicated below and flowing at a temperature of 80° F. is *0.010975 centipoises or 0.00000738 lb./ft. sec. units* = μ. (c)

(c) Perry—Chemical Engineers Handbook, P. 674.



$$R_e = \frac{0.673 \times 780 \times 0.0478}{0.00000738} = 3{,}400{,}000$$

Again it might be more convenient to use a variation of the formula

$$R_e = \frac{D\,U\,S}{\mu} = 0.0201 \frac{Qn}{dz}$$

Where Q = cu. ft. per *Day* (=24,000,000)
n = specific gravity (0.625)
d = Diam. in inches (8.071)
z = Viscosity in centipoises = (0.010975)

$$R_e = 0.0201 \times \frac{24{,}000{,}000 \times 0.625}{8.071 \times 0.010975} = 3{,}400{,}000$$

It will be noted that this figure is the same as the value of R_e derived by formula (IV) above.

Referring now to the curve showing R_e vs. Friction Factor we find f=0.00310

$$P_1^2 - P_2^2 = \frac{0.00030616 \times (1{,}000{,}000)^2 \times (0.625) \times (540) \times (36) \times (0.00310)}{8.071^5} = 336{,}705$$

If, now, we assume an initial pressure of:—

P_1=800 lb. gauge or 814.7 lb. absolute

$814.7^2 = 663{,}735$

Minus 336,705 = 327,030 = P_2^2

Terminal Pressure P_2 = 571.9 lb. absolute

= 557.2 lb. gauge

On the other hand, if initial and terminal pressures are known we can solve for Q by using formula (I)

$$Q = 57.1505 \left[\frac{[(814.7)^2 - (571.9)^2] \quad (8.071)^5}{0.625 \times 540 \times 36 \times 0.00310} \right]^{1/2}$$

(Strictly speaking R_e and f must first be determined by trial and error. However, in this case we know these values).

Q=1,000,000 cu. ft. per hour or 24,000,000 cu. ft. per day. This checks the previous calculation.

All the foregoing is based on the assumption that gas under compression follows Boyle's Law:—PV=P′V′=K. It is known, however, that as pressures are increased all gases deviate materially from this law. The deviations are known accurately for a great many gases, and they vary with the pressure to which the gases are exposed. It remains to apply the correction to the conditions existing in the transmission line. We can readily see that it would not be correct to take the initial pressure as the correction point, since the pressure, and with it the deviation from Boyle's Law, decreases as the gas passes along the main. The average pressure is also not acceptable, since the pressure gradient along a pipe line approximates a parabolic curve. It has been suggested (d) that the correction should be made for a mean pressure, P_c, determined as follows:—

$$P_c = \frac{2}{3}\left[(P_1+P_2) - \frac{P_1 P_2}{P_1+P_2}\right] \quad (V)$$

In this instance

$$P_c = \frac{2}{3}\left[(814.7+571.9) - \frac{814.7 \times 571.9}{814.7+571.9}\right] = 700 \text{ lb. absolute}$$

On the basis of laboratory investigations it has been determined that

(d) T. R. Weymouth—Trans ASME—1912, P. 203.

the deviation from Boyle's Law can be computed by means of the following formula (e):—

$D = a P_1 + b P_2 + c P_3 + d P_4 + \text{etc.}$

Where D = Deviation in percent

a, b, c, etc. = Percent deviation per atmosphere for various gases as determined from charts (f)

P_1, P_2, P_3, etc. = Partial pressures of corresponding gases expressed in atmospheres.

If the pipe line transmits a gas of the following composition and the correction pressure $P_c = 700$ lb. absolute (47.6 Atmospheres) the correction for deviation from Boyle's Law may be developed as follows:—

Composition	%	*Partial Pres. (Atm.)*	*% Deviation per Atm. (f)*	*Total Deviation* %
CH_4	83.0	39.6	0.225	8.9
C_2H_6	7.0	3.3	0.998	3.3
O_2	0.4	0.2	0.060	—
CO_2	2.6	1.2	0.654	0.8
N_2	7.0	3.3	0.020	—
	100.0	47.6		13.0

While according to Boyle's Law, assuming a "perfect gas," a volume of 50,000 cu. ft. of gas under 1 atmosphere of pressure would be compressed to 1000 cu. ft., under a pressure of 50 atmospheres, with gases encountered in practice, the gas would, generally speaking, be reduced to a smaller volume than called for by the equation $PV = P'V' = K$. The deviation correction of 13% indicates that V′ is actually only 100—13=87% of the theoretical volume, i.e., V′ actual = V′ theoretical × 0.87.

Referring to the above figures:

$$P \times V = P' \times \frac{V'}{0.87}$$

$$1 \times 50000 = 50 \times \frac{V'}{0.87}$$

or V′= 870 cu. ft., and not 1000 cu. ft. as would follow from Boyle's Law. Again, if it were required to compress 50,000 cu. ft. at atmospheric pressure to 1000 cu. ft. at a higher pressure, it would be necessary to compress the gas, not to 50 atmospheres, but only to 50× 0.87 or 43.5 atmospheres, approximately.

(e) Technical Paper #158—Bureau of Mines.

(f) Gas Engineers Handbook PP 657-662.

In attempting to apply the deviation correction to the flow of gas through a pipe line it will be at once apparent that the correction enters into:—Volume Q and Specific Gravity G. The Reynolds' Number $R_e = \frac{DUS}{\mu}$, may also be expressed by the formula $R_e = \frac{DG}{\mu}$ where G is the mass velocity of the gas in lb. per sq. ft. per sec.; and since the mass of a given volume of gas is not affected by compression, it is evident that deviations from Boyle's Law do not affect the Reynolds' Number and consequently the friction factor.

The answers we obtained for Q and $P_1^2 - P_2^2$ were of course computed on the basis of the perfect gas laws and a correction must be applied. The application of the deviation correction may be derived from Bernouilli's fundamental equation (in differential form) for the conservation of energy of fluids in motion:—

$$dz + Jdu + PdV + VdP + \frac{wdw}{g} = JdQ + d(wk_0)$$

However, the process is mathematically involved and for the present purpose we can deduce the correction method by analogy from the similar correction (g) applied to the flow of gas through orifice meters:—

$$\text{Correction Factor} = \left[\frac{100}{100\text{-}D}\right]^{\frac{1}{2}} \quad \text{(VI)}$$

Where D = percent deviation from Boyle's Law (in this case 13%)

$$= \left[\frac{100}{87}\right]^{\frac{1}{2}} = 1.0721$$

Therefore:—

Q actual = theoretical × 1.0721

In the case cited, using equation (I) to determine Q, the actual quantity of gas delivered under the conditions assumed and with a pressure drop from 800 lb. to 557.2 lb. will therefore be 1,072,000 cu. ft. per hour or 25,800,000 cu. ft. per day.

(g) Natural Gas Handbook, John C. Diehl, 1927 Edition P. 202.

When the pressure drop is to be determined and equation (II) is used, the terminal pressure must first be determined by trial and error, then the deviation correction computed, and $(P_1^2 - P_2^2)$ multiplied by $\frac{100\text{-}D}{100}$.

Equations (I) and (II) may be written to take the deviation correction into account, when they will read as follows:—

$$Q = 57.1505 \left[\frac{100(P_1^2 - P_2^2)d^5}{(100 - D)GTLf}\right]^{\frac{1}{2}} \quad \text{(VII)}$$

$$P_1^2 - P_2^2 = 0.00030616 \frac{(100 - D)Q^2GTLf}{100d^5} \quad \text{(VIII)}$$

Of course, in order to determine D with any degree of accuracy, approximations must first be made by solving formula (II) for P_1^2 and P_2^2 and formula (V) for P_c, the mean pressure.

The error introduced in this example by leaving out of consideration the deviation, and amounting to approximately 7%, is too large to be neglected. It appears necessary to apply this correction when operating under high pressures and especially in marginal cases where the energy required to carry a desired quantity of gas through a given pipe line appears to tax to the utmost the maximum pressure drop available. The correction for volume change appears particularly important when it is considered that at low flowing temperatures the deviation from Boyle's Law of some of the components of natural gas becomes materially greater than the deviations indicated above.

Nothing in this discussion is based upon original research work in the field and the conclusions arrived at are predicated, not on the development of new information, but upon the interpretation of data developed by others. The principal reason for placing this matter before readers who may be interested is the hope that the suggested formulae will be checked against actual tests. It is suggested that data developed from actual field test work on existing pipe lines, in which the flow of gas is accurately measured, and pressures, flowing temperatures, specific gravities and analyses of gases have been determined, be related to the formulae outlined herein.

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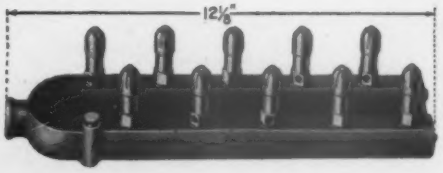

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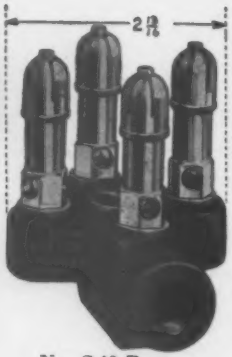

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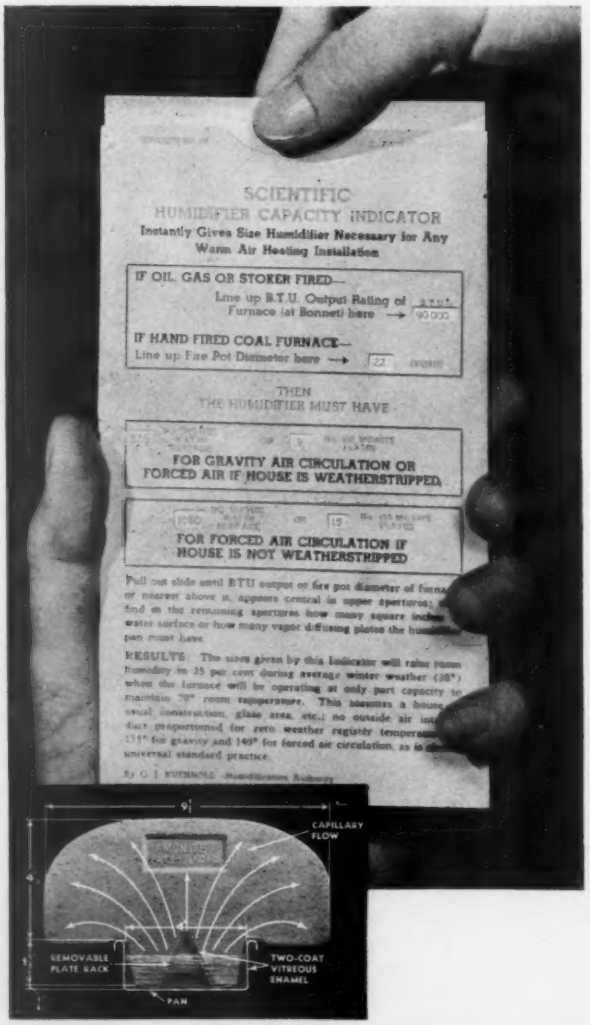
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B. C. Electric Has Vigorous Gas Campaign In Progress

By
F. H. Fullerton
Vancouver, B. C.

GAS APPLIANCES have been merchandised during the past few years with great success by plumbers, heating engineers, hardware stores, department stores, and furniture dealers in co-operation with the British Columbia Electric Railway Co.'s gas division under its dealer co-operation program. This plan covers all appliance sales activities of the B. C. Electric in both its electricity and gas divisions, and an arrangement worked out between the company and the Vancouver Sanitary & Heating Engineers & Sheet Metal Association has been an important factor in the success of the plan.

There are now 33,000 gas ranges in service in the mainland territory of the B. C. Electric in Vancouver and adjacent cities, which means saturation of the company's 45,000 odd gas customers has been estimated to have reached 34.7% of potential sales. In the same area 3,700 gas storage and 8,500 gas side arm water heaters are in service, giving 15.6% saturation when electric heaters in use are considered. The average selling price of gas ranges handled under the co-operative campaign in the past year was worked out at $118.75. Under the dealer plan for 1941 there is a quota of 650 gas range sales by the dealers and 800 by the company, or a total of 1,450.

The Victoria branch of the B. C. Electric estimated that a saturation point of 20% has been reached in gas ranges and 9.4% in gas water heaters in the Vancouver Island area. The quota for 1941 in this territory is 175 company and 35 dealer gas range sales, and a total of $35,500 in gas appliance sales for the area.

The Survey

G. S. Dawson, supervisor of gas sales for the B. C. Electric states that approximately 34,000 homes in the Greater Vancouver and New Westminster area are using gas for cooking and that it would be conservative to estimate that 20,000 of these are using old fashioned ranges which should be replaced immediately. He also states a recently completed survey shows that more people in this area are using gas than any other single fuel, and that more people are also contemplating changing over to gas for cooking. He points out prospects for sales are thus brighter than at any time in the history of the territory, and that this business in gas appliances is awaiting aggressive salesmen.

As one step towards more intensive development of the gas appliance market in Vancouver a gas range sales committee has been formed, consisting of representatives of all gas range manufacturers and members of the B. C. Electric staff. This committee will co-ordinate the promotional efforts of the manufacturers and the utility so that the best results can be secured.

Dealer Sales Plan

In the main there have been few changes in the dealer sales plan for this year as effecting gas appliances. Dealers are asked to turn in to the B. C. Electric a monthly statement of itemized gas appliance sales on a form provided and where sales are in excess of $25.00 the company will pay $1.00 for the report.

The company will set aside an allowance for each dealer of $5.00 on each straight gas range sold and $2.50 for each gas combination range where gas is one of the oven fuels, and $1.00 for each gas refrigerator sold. These amounts will be held in a special advertising account and paid out to the individual dealers subject to their submission of advertising in approved media, such as newspapers, radio, billboards, theatre screen, car cards, etc. The company will pay 100% of the submitted and approved dealer advertising up to the value of allowances credited his account on the basis of allowance per sale. Advertising must feature gas cooking, gas refrigeration or gas water heating.

Installation Allowances

Definite installation allowances are made by the company with a view to development of the gas load.

Free installation up to a maximum of $10 plus permit fee is granted on all straight gas ranges listed at less than $100, and $15 on all ranges listed at over $100. For combination ranges the $10 allowance is made when gas is one of the oven fuels. Free gas installation does not include the cost of running gas service from the gas main to the nearest point inside the building, a flat charge of $5.00 being made for this service up to a maximum of 70 feet on the customers' property, plus 30c per foot for all additional footage. Reduced allowances are made subject to certain conditions in case of transfer of gas ranges.

Trade-In Allowances

The B. C. Electric has also developed a scale of trade-in allowances on gas ranges. Where a straight gas range listed at less than $100 is bought the allowance is $10, or $15, where the new range lists at $100 or more. In the case of Certified Performance ranges a $20.00 allowance is made on the trade-in. The old range must have been in the service of the customer on B. C. Electric gas mains for a minimum of 12 months previous to the trade-in, and the allowance must be part of the customer's contract with the dealer.

Where a new all gas range is installed under the free installation plan a tank type water heater will be installed at the same time if the customer wishes to pay $5.00 additional. Plumbers and other dealers qualified to install the heaters will be allowed to do so by the B. C. Electric and will be paid by them up to a maximum of $11 per installation. Payment will be made on a time and material basis. A bonus of $1.00 per water heater will be paid to dealers as a result of a dealer order for a gas water heater.

Contractor's Bonus

In cases where dealers or plumbing and heating contractors turn in the name of a prospect to be sold by the B. C. Electric's own sales staff the name of the prospect will be registered, provided it has not previously been received from any other source. A bonus of $5.00 will be paid when the sale is made in the case of gas ranges, gas central heating systems; and industrial gas heating units. On gas fire and gas refrigerators the bonus for prospects sold is $1.00 and on floor furnaces $2.00, while heatrola unit bonuses range from $1 to $2.00 depending on size.

Water Heater Rental

One change this year in the gas water heater rental plan is the demand for a down payment of $5.00 in addition to the 50c per month rental. This is designed to prevent customers signing up for the installation without giving it any serious consideration. It is not expected this change will discourage any responsible customers, and it is estimated that at least 625 of these units will be installed in 1941 in the Vancouver-New Westminster area.

The B. C. Electric has enlarged its dealer co-operation and sales promotion staff to aid in development of new business, and the full resources of the company's advertising, publicity, merchandising, and display departments are at the disposal of co-operating dealers and contractors in seeking solution of their problems. The resources of the service department of the company are also placed at the disposal of the dealers and their customers.

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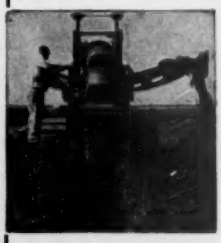

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Studies in Microbiological Anaërobic Corrosion

Part 3

By

Raymond F. Hadley

Susquehanna Pipe Line Company,
Philadelphia, Penna.

The Relation of Microbiological Anaërobic Corrosion to Soils and Soil Tests

In studying the microbiological anaërobic corrosion process it becomes more and more apparent that soil studies *per se* are more suitable for use as a criterion in evaluating microbiological anaërobic corrosion than they would be in determining corrosive locations resulting from stray current electrolysis. Adjustment, either by nature or by man, of the conditions influencing the growth of the sulphate-reducing bacteria, as mentioned previously in this paper, are the basic factors which will determine whether or not microbiological anaërobic corrosion can take place. It is readily conceivable that practically any soil may become potentially dangerous from a corrosion viewpoint through the activity of the sulphate-reducing bacteria, provided the conditions affecting their growth are so adjusted that these factors will lie within the optimum growth limits. Confirmation of this point may be taken from the fact that the sulphate-reducing bacteria have been isolated from practically every type of soil, not only in the United States, but throughout the world. Their presence in the soil, however, does not necessarily imply that the soil must be corrosive.

Investigations of the microbiological anaërobic corrosion process are not to be considered, in any sense, as being typically field problems. The natural field environment of these microorganisms can be reproduced in the laboratory by the development and application of microbiological technique, thus allowing the study of the microbiological anaërobic corrosion process to be carried out under more closely controlled conditions than in the field.

A rapid and accurate method by which the corrosiveness of any given location could be determined from the soil properties prior to, or after, pipe line construction has long been the "philosopher's stone" to corrosion investigators. Many such test methods have been developed, some worthy, others ingenious, and still others based on the guesswork of desperation. An excellent summation and comparison of the better known methods thus far used has been made by Logan and Koenig. No one method or any combination of these test methods, however, has in practice yielded results of sufficient precision to bring its use into universal demand. It is perhaps significant to note, that in not one single test method thus far tried, has the microbiological aspect of anaërobic corrosion been considered. It is, however,

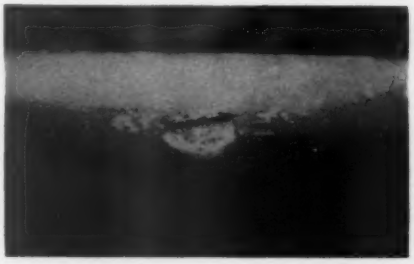


Fig. 2—Pit found where organic debris (cellulose) was in contact with pipe. Note condition of remainder of pipe surface.

the opinion of some corrosion men, that if a method can be found to quickly and accurately evaluate the influence of microbiological anaërobic corrosion at any given location, some degree of order may be forthcoming in this present field of chaos.

The characteristics inherent to the microbiological anaërobic corrosion process rather definitely eliminate the use of soil resistivity measurements in making any evaluation of bacterial corrosion. The anodic and cathodic areas are not only too closely interspaced, but they also are believed to be continually shifting, thus reducing to a minimum any influence of soil resistivity. Electrical measurements of current discharged from the pipe are also of little value, except in a negative sense, for the anodes and cathodes are so closely coupled to one another that their external electrical influence is of such a low order of magnitude that precision measurements are practically impossible. The analysis for total acidity seems offhand to bear a closer relation to bacterial corrosion than any of the other suggested test methods; provided, of course, bacterial corrosion can be correlated with the $(SO_4)^{--}$ concentration in the soil or soil water. To date our investigations have not revealed any such correlation. To use Denison's electrolytic test cell would require certain changes of design and operation before any evaluations of bacterial corrosion could even be attempted. The first of these changes would necessitate provision for keeping the soil and electrodes anaërobic. The second change would require the observation time to be sufficiently increased to make sure that the sulphate-reducing bacterial cells had reached the logarithmic death phase rate. Even then, it is doubtful if the cell would yield results of any great value except perhaps in water saturated soils, for any change in oxygen tension of the soil sample, between field conditions and test cell conditions, may be the determining factor whether bacterial growth will, or will not, occur. Pearson has more recently suggested the use of identical electrodes for field use, which can be cathodically polarized after insertion in the soil, the rate of cathodic depolarization of the electrode may represent, at least in part, a measure of the sulphate-reducing bacterial metabolic activity. Experimental investigations of this test method, however, have not as yet been carried out, although the method holds some promise of being successful.

Cellulose and Microbiological Anaërobic Corrosion

Cellulose may be defined as a polysaccharide $(C_6H_{10}O_5)_n$ obtained from such substances as wood, cotton, linen, hemp, etc., of which it is the chief ingredient. It is also the chief constituent of the cell wall of plants.

The literature does not record any of the more common corrosion processes in which cellulose plays any part; and yet, in the microbiological anaërobic corrosion process cellulose

plays, one of, if not the most important role in determining whether or not anaërobic bacterial corrosion will occur. Chemically, cellulose is highly insoluble and practically inert, however, biochemically it is readily decomposed by many aërobic and anaërobic microorganisms. The sulphate reducing bacteria, i.e., the bacteria responsible for anaërobic corrosion, are not believed to be able to decompose cellulose. In nature the sulphate-reducing bacteria are not found in pure cultures, but rather in association with many other kinds of bacteria, many of which, both aërobic and anaërobic, do possess the ability to bring about the decomposition of cellulose. These saprophytic bacteria are able to utilize the cellulose as a carbon source for their own metabolic processes, leaving as a result of this decomposition such substrates as alcohol, lactic acid, acetic acid, mannitol, glucose, hydrogen, methane, butyric acid, formic acid, some of the higher fatty acids, etc. Thus the sulphate-reducing bacteria although unable to decompose cellulose themselves are assured of a plentiful supply of organic substances which they can utilize as carbon and hydrogen sources, so long as cellulose and the other saprophytic microorganisms are present. It is then apparent, if all of the other growth factors are favorable, the activity of the sulphate-reducing bacteria and hence the degree of corrosion, should be related in some manner to the quantity of cellulose available.

It hardly seems necessary to recall to pipe line men, particularly pipe line men affiliated with the gas industry, the association between corrosion and wood (cellulose). It has been common practice in the gas pipe line industry to support the pipe on wooden blocks during construction. Too frequently, either by design or by accident, these wooden blocks have remained in place after the line was constructed and the backfill thrown into the trench on top of them. In some instances, those factors affecting the bacterial metabolic processes were not within the limits for optimum growth, and no trouble ensued. In others they were, and severe active corrosion of the pipe could be found for approximately a foot radius around each wooden block. It will perhaps be recalled in this connection that in those locations where the severe active corrosion occurred, the ground was nearly always water saturated. It has long been the byword among pipe line construction "hands" not to leave skids in the trench next to the pipe, particularly hickory wood skids. The reason for specifically singling out hickory skids is not known to the writer. However, any cellulose left in contact with the pipe represents a potential source of danger.

Wood has been specifically referred to in the preceding illustrations, nevertheless, it is to be remembered that grass, weeds, leaves, roots, etc., all represent a hazard of comparable degree. It has frequently been observed in many locations where microbiological anaërobic corrosion was in progress that deep pits or even slabs were found in the pipe where vegetation or clods of grass had been thrown around the pipe during construction. The corrosion products in such instances consisted principally of FeS and $Fe(OH)_2$. Active cultures of the sulphate-reducing bacteria have, in every instance thus far tried, been readily cultured from this mixture of decomposed cellulose and ferrous salts found on the pipe over the pits.

The absence of visual quantities

Fig. 3—Hemp rope contains cellulose and should therefore not be left in contact with the pipe.

of cellulose in the soil is not to be considered as a definite indication that microbiological anaërobic corrosion will not occur in such locations. The sulphate-reducing bacteria are dependent upon cellulose only in a secondary manner and it is entirely possible that the soil water may carry in solution sufficient quantities of those substrates, mentioned previously in this paper, to enable active growth of the sulphate-reducing bacteria to take place. Situations of this kind are particularly apt to occur in locations where the soil is water saturated or inundated.

Heretofore, although the correlation of corrosion with cellulose has been observed many times by pipe line men, in diverse locations, little or no attempt has been made to ascertain the mechanism by which the process functions. Much of the microbiological anaërobic corrosion has thus, in the past, been attributed to acid corrosion caused by humic acids in the soil. The fallacy of such an explanation is apparent, for, the humic acids, resulting from the decomposition of humus, are complex organic acids with low degrees of ionization. Even if these acids were produced in relatively large quantities, therefore, it is doubtful if they could contribute much to the corrosion process. It is furthermore hardly conceivable that in pH 6.0-8.0 soil water, the range in which microbiological anaërobic corrosion ordinarily occurs, that the concentration of these acids could vary from point to point over the pipe surface at such a rate as would account for the "spottiness" of the corrosion actually found in the pipe. Such an explanation would require the acid to exist in small discrete volumes, separated, as it were from the water, like stones are from water. Actually, the decomposition of humus in nature appears to result from microbiological metabolic processes, CO_2 being steadily evolved. Various other substrates also result from the decomposition of humus, some of these compounds being, benzoic acid, acrylic acid, cytosine, lysine, leucine, vanillin, etc., which probably act as organic sources of energy for saprophytic soil bacteria.

von Wolzogen Kühr, and more recently, Bunker have suggested the possibility of cathodic hydrogen depolarization resulting from microbiological processes other than sulphate reduction. One, of the several microbiological depolarization processes thus suggested, is cathodic depolarization by the methane bacteria commonly associated with anaërobic cellulose decomposition. A depolarization of this type may be represented as:

$$CO_2 + 8H \rightarrow CH_4 + 2H_2O$$

The writer has not yet had an opportunity to observe the occurrence of such a process in the field. One location is, however, known where vigorous methane production is in progress in the bed of a river whose water has been stagnated by the construction of a dam below the pipe line point of crossing. At this location extremely active cultures of the sulphate-reducing bacteria were obtained from the organic debris decomposing in the river bottom. Such close association between the methane producers and the sulphate-reducing bacteria would appear to substantiate the examples previously mentioned in this paper, rather than to suggest depolarization was being accomplished at this location by the methane bacteria. The correlation noted elsewhere in this paper, between the quantity of FeS in the corrosion products and the amount of organic

material observed in the soil, is also more in agreement with sulphate reduction than with methane production. This does not necessarily imply that cathodic depolarization by the methane bacteria is unlikely; but rather it has, in our work, either not been observed, or has not been recognized.

The study of the various cathodic depolarization processes thus again returns to the basic mechanism by which this cathodic hydrogen is removed, viz., does the cathodic hydrogen enter directly into the metabolic activity of the sulphate-reducing bacteria or is it removed through combination with the products resulting from their metabolic processes. If the first of the above statements is proven to be true, it then appears probable that any microbiological process, which can act as a hydrogen acceptor, will be capable of affecting cathodic depolarization. If the second premise is ascertained to be correct, then *a priori* the microbiological anaërobic process of sulphate reduction may stand alone in the field of microbiological anaërobic corrosion. In either event, microbiological cathodic depolarization may be considered factual, for it is only in the interpretation of the mechanism by which this microbiological depolarization process operates that controversy exists. This question, therefore, appears to be paramount, and the answer must be forthcoming before a precise evaluation can be made of other microbiological anaërobic depolarization processes. These other methods of microbiological cathodic hydrogen removal, however, certainly warrant consideration and examination, not only in the field, but also in controlled laboratory corrosion experiments with pure cultures of the respective microorganisms.

Conclusions

From the data presented in this paper, it may be concluded that:

(1) The basic theory underlying the microbiological anaërobic corrosion process is in accordance with the more commonly accepted electrochemical theory of corrosion, the principal differences being the manner by which the cathodic hydrogen polarization is removed, and the mechanism causing the suppression of the ferrous ions.

(2) One of the component salts of the products of corrosion is FeS which, in the concentrations found under the stated conditions, can result only from the metabolic activity of the sulphate-reducing bacteria and may therefore be taken as an indication of bacterial corrosion, if found in the corrosion products.

(3) The prevalence of microbiological anaërobic corrosion, as shown by numerical data obtained from pipe lines in certain eastern states, is astonishingly common and is sufficient to account for a large quantity of the corrosion of the pipe lines from which these data were obtained.

(4) Pit distribution curves show that for similar locations, geographically very close together, the pit depths where bacterial corrosion occurs are greater than pit depths found at locations where bacterial corrosion is absent.

(5) Pits occurring in a pipe at a location where microbiological anaërobic corrosion is not present do not represent the same degree of hazard, as do the characteristic slabs of the same depth found in locations where the sulphate-reducing bacteria are active.

(6) The microbiological anaërobic corrosion process is not a process of the "self-stifling" variety. The pit depth rate instead of decreasing with time, actually show a pronounced increase with time in some locations where the sulphate-reducing bacteria are active. Reference is made to other corrosion investigators who have observed similar increasing rate pit depth-time or weight loss-time curves.

(7) Test methods now commonly employed in the evaluation of the corrosiveness of soils are discussed and shown to be of little, if any, value in predicting the occurrence of microbiological anaërobic corrosion.

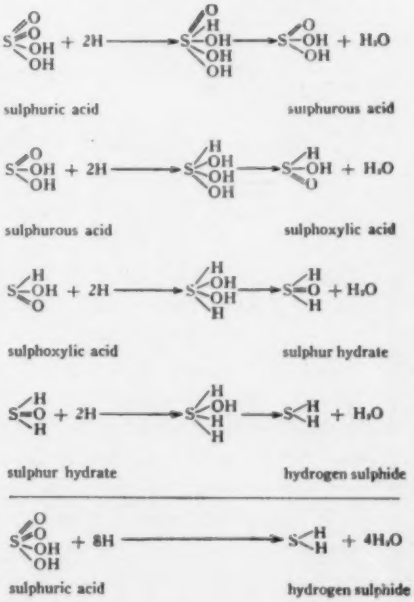
(8) The decomposition of cellulose in the soil is shown to be closely related to the microbiological anaërobic corrosion process, whereas, with other types of corrosion processes cellulose decomposition plays such a minor role that it is scarcely considered in corrosion literature. A discussion of the previous concept of the corrosion associated with cellulose decomposition is included and attention is directed to certain fallacies in the previous explanation of such corrosion.

(9) Attention is called to other microbiological anaërobic depolarization processes, theoretically possible, according to the von Wolzogen Kühr theory of cathodic depolarization. Certain questionable phases of the von Wolzogen Kühr theory of cathodic depolarization are pointed out and briefly discussed. The data presented in the paper substantiates the factuality of microbiological anaërobic cathodic depolarization, however, it leaves as an open question the exact mechanism by which such depolarization is accomplished.

(10) The data available at the present time from American sources relative to microbiological anaërobic corrosion is sadly inadequate, and should be supplemented by additional data pertaining, not only to the phase boundary reactions of the process, the quantity and geographical distribution of this corrosion, but also to investigations of methods by which it may be economically minimized.

Appendix A

Scheme for the Mechanism of the Reduction of Sulphates to Hydrogen Sulphide



* *Table XXVIII, page 72, "The Chemical Activities of Micro-organisms," A. J. Kluyver, University of London Press Lt., London, 1931.*

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For the past 7 years Mr. Lyons has been associated with The Fox Furnace Company and The American Radiator and Standard Sanitary Corporation at Elyria, Ohio.

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The Vegetation Method of Locating Gas Leaks

By
Milton W. Heath
President Heath Tree Service, Inc.
Wellesley, Mass.

EARLY in the last decade, a very severe winter was experienced in New England, and some other Eastern states. The following spring and summer, gas companies received many claims for gas-injured trees, shrubs, and lawns. Some of these claims were legitimate—many were not. The utilities were in a difficult position as to which claims to pay, and which not to pay. My organization gave every assistance to help these companies place a fair value on the damage, as well as to prepare briefs for court cases where our men were called as expert witnesses. Our reports helped bring many a case to a friendly and satisfactory end.

One case, however, was more serious. A city brought suit for damage done to its trees, claiming that they had been killed by gas. A thorough inspection showed some gas injury, and we treated the trees, thereby saving over 90% of them. Today these same trees are in better condition than other ones in the vicinity. We were able to make a complete settlement with the City, and the cost of settlement plus our fee, totaled less than 10% of the amount of the claim. The original amount, by the way, was based on values set some years earlier by the courts of the same district. A Survey of the rest of the distribution system in this city revealed other situations which, while not serious enough to be noticed by the laymen, were readily recognized by our experts, and conditions were remedied before claims arose by simply repairing the gas leaks.

A thorough study of the results followed. At the same time I happened to be reading a story about the procedure of paying doctors in China. Apparently the Chinese pay their doctors a regular fee while they are well, and when they get sick, the fee ceases during the illness. Now if we were as good tree men as we hoped, we might be able to locate injured foliage months, or even years before it would otherwise be recognized—A gas leak could be spotted and fixed before permanent injury had resulted—("locking the barn door before the horse is stolen"). As with the Chinese, we would be paid for keeping the patients (trees) well. The following year, several hundred miles of mains were available for a trial, and the results were even more favorable than we had hoped.

As stated, this service started out as a tool to facilitate the handling of claims. This continues to be very important, and today we report on any foliage injury that might be mistaken for gas injury, but definitely is not, as well as reporting on the cases that are gas.

The following is a summary of what has been done to date:

50,000 miles of mains have been surveyed (many of these on an annual basis—therefore repeat mileage)

Several million trees have been observed;

Many thousand trees, shrubs, and lawns saved.

60,000 cases have been written up;

Thousands of claims prevented —others settled at no cost.

50,000 new gas leaks have been located.

The average cost has been $1.50 per mile.

The average cost has been $1.50 per leak.

Estimated amount of gas saved —several billion cubic feet.

"Why don't gas companies do this job themselves?" I don't know the rules pertaining to answering a question with a question, so will say, "Why do gas companies hire a doctor, a dentist, or an auditor?" Because certain services can be rendered more economically by an outside party. Either there is not enough work to make it a full time job, or, as in the case of an auditor, the report is more valuable when made by a third party. This covers only part of the answer, however. The most difficult task, the training of men to do this work, is the rest of the answer. Less than 1% of the good tree men make good diagnosticians, or Survey men—similar, probably, to the small number of even A-1 doctors who can diagnose approaching illness quickly and correctly. The secret of success is finding a man who was *born with the ability to diagnose*, who has years of experience, coupled with the very thorough training given in our own school. In addition, he must have a liberal sprinkling of common sense, and a personality that will allow him to make this mixture function. With the above characteristics, it is still necessary to have the prospective Survey man go on actual field Surveys as a student with several men who have already proved themselves. After the student has been given an O.K. by these instructors, he will then be given an opportunity of his own. Locating gas leaks is not magic, but it is a fact that while there are no "rabbits to be brought out of the hat", this Survey work is a highly specialized field.

The special training and experience which has been emphasized makes it possible for our men to diagnose a case much more speedily, and in much earlier stages than the layman can. Vegetation has its "normal green", varying at different times of the year, and other characteristics that only the "man who knows" can check on.

To prove this point, several distribution systems were covered, as follows:

System A: First covered by a gas man, and followed by a tree man.

System B: Covered first by a tree man; secondly by a gas man.

System C: Covered by a gas man and a tree man together. So far, the tree man has won the decision in all cases on both counts of finding more leaks, at less cost.

Paper given before the Technical Section, Pacific Coast Gas Assn. at Coronado, Cal., Sept. 18-20, 1940.

How are these Surveys made?

1. The Vegetation expert rides over the streets where mains are located at a speed not to exceed six or eight miles per hour or, depending upon foliage conditions, he may walk over certain parts of the areas.
2. The Vegetation expert spots a case that falls into the gas injury group. He makes out a report on the *condition, location, species,* etc., for valuation, and a complete report of diseases infecting the plant. If he decides that there is a gas injury, he makes a final check of the soil and checks for gas in the root area, depending upon how noticeable the symptoms are. This check with a meter is made so that the gas company will save a trip out to make a similar test. Otherwise, there might be certain border-line cases where we were not positive of the cause of the injury. Reports are made when gas is the cause of the injury as well as when gas is not a major factor.
3. He makes a report of the gas main location by a sketch on the back of the report and grades the leak (small, medium, large) if a leak exists. This goes to the gas company daily. The complete report is sent out to the main office for checking, indexing, etc., and a copy is returned to the gas company later. The expert may recommend treatment depending upon local conditions, and the experience of the local gas company with like situations.
4. A double-check of conditions near green houses has paid real dividends.

"Tools of the Trade"

A. One Vegetation Expert with—
   1. Good eyes.
   2. Common sense.
   3. Complete knowledge of vegetation and its ills.
   4. An alert mind.

B. Material
   1. Car (with guide).
   2. Combustible gas meter.
   3. Needle bars.
   4. Increment Borer.
   5. Soil Testing Equipment.
   6. Report Forms, etc.

As regards complete steps in the process of injury to vegetation by gas, many things are yet to be learned on this subject, but, after years of field and laboratory investigation, the following conclusions have been reached.

Gas injury to vegetation results from gas being present in the root areas, not in the air above the ground. In the case of Manufactured gas— 1. The existence of Cyanogen or Hydrocyanic Acid, even in small amounts has a toxic effect on cell structure. The poison is accumulative, similar to that of lead in the human body. 2. Displacement of oxygen in the soil (usually by carbon monoxide). Oxygen is vital to plant life, being necessary in the process of changing the minerals and vegetable matter into a usable form of plant food for the roots to take up. Natural gas does not have the same toxic effect on cells, although ethylene, propylene, acetylene, butylene, etc., are known to be harmful. It does, however displace the oxygen causing an unbalance to the normal bacterial and other soil processes, thereby smothering the vegetation or starving it. Also, natural gas is usually dry, and will desiccate the root area and kill the hair or feeder roots (dry manufactured gas does the same thing.)

In addition to general indications, there are a number of definite symptoms which are known to exist. For instance, a certain fungus, (nicknamed by our men "gasbug"), apparently attacks only gas-injured trees, the formation of a jelly-like growth in the cambium layer on certain species of trees indicates gas injury, a distorted structure in the growth of grass blades appears only when grass has been gas-injured. In certain cases, gas will cause a turning down of the leaf stems, called epinasty. This is caused by too much stimulation, due to ethylene, and once caused a misstatement that gas was good for plants. These symptoms, with many others to which we are now giving further study, must be given a thorough check and cross-check before putting on the permanent record. This is being done, and the information will be passed along as soon as it is available. Our studies show that certain trees, shrubs, and grasses seem to be more resistant to some types of gas. However, the indications in certain species of trees vary considerably. We find that a small gas leak over a long period of time may cause the leaves of a tree to be greatly reduced in size, result in partial or complete discoloration and abscission. The discoloration may be general or localized to individual leaders (main branches). Quite often, there are a number of scattered dead branches in the crown of the trees. On the other hand, a larger amount of gas over a shorter period may result in the drying, killing, and wilting of the leaves, with or without discoloration or abscission, generally followed by death of individual limbs or the top of the tree, the latter giving a "stag-head" appearance. This is especially noticeable in Elms and Maples. It is quite possible that distinct proliferation will be noted, especially in Poplar, Willow, and some other fast growing species. The exact causes as well as the various stages of injury are still being studied. This lack of certain facts does not affect our results. Referring again to the human being, there are many diseases for instance, cancer, the causes of which are not fully known as yet, but the existence of the disease is admitted, and it can be recognized in its early stages, and, in many cases, cured.

The steps that we have followed in successfully treating trees are:

1. Eliminating source of gas leakage (repair leak).

2. Thorough soil aeration (the suction method is believed to be more practical than the older system of blowing the gas out).

3. Making a soil test to determine the type and strength of the mineral constituents necessary to increase the vigor of the tree; fertilized the tree with a properly balanced plant food.

4. Systematic sub-soil irrigation by means of installed dry wells.

5. Pruning of decayed branches one season following the injury.

The above method of treating gas-injured trees has proved quite successful, although the fact still remains that certain trees that were treated, but not expected to respond, did survive and appear in good condition today, while other cases that did not appear serious at the time, failed to respond, and death could not be averted.

Experience proves the Vegetation Method. The following is a direct quotation from a paper presented by a gas company official, giving his reasons for using this service:

"1. Very low cost per mile (only one method of survey can locate more leaks, and this is to bar every 12 to 18 feet and test with a combustible meter with costs running very high).

2. Speed of completion.

3. It is not conspicuous, and will improve public relations because of the simplicity and speed of the method.

4. This method offers a way of relieving existing small organizations from the responsibility of laborious

surveys and permits time to complete the general routine daily work more easily and effectively.

5. It provides a very economical method of leakage correction and pays a very nice return on the money invested in the survey.

6. It gives a systematic and accepted standard method of leakage correction which should combat accusations of negligence and damage suits.

7. It applies to manufactured gas, natural gas, butane-air gas, etc."

** Based on Surveys made by Heath Tree Service Inc. for several hundred gas companies in thirty states and part of Canada.*

Results of the Vegetation Method of Locating Gas Leaks
The Balance Sheet of an Average Small Gas System

ASSETS **Estimated Results*		*LIABILITIES* **Estimated Costs*	
Number of miles of main	100	†Survey Cost	$180.00
Number of gas leaks located	106	Repair costs	$800.00 to $1600.00
**Number of cubic feet of gas saved:	4,000 M to 16,000 M	Total	$980.00 to $1780.00
Dollars saved (Est. at 30c M)	$1200.00 to $4800.00	Estimated savings, without additional value of handling claims, for first year:	$220.00 to $3020.00

*** Based on results given by gas companies that made metered tests of actual leaks under normal field conditions on low pressure systems. (Average is somewhere between these limits).*

† This cost gets lower as the mileage increases. The average cost last year was $1.44 per mile.

New Pipe Line in Alberta

Completion of financing in New York has now paved the way for the construction of a pipeline over 100 miles in length from the large Kinsella gas field near Viking, Alta to Red Deer, Alta, through Camrose, according to an announcement by E. W. Bowness, Calgary, vice-president of the Canadian Western Natural Gas, Light, Heat and Power Co. of that city.

The pipeline will provide Wetaskiwin, Ponoka and Red Deer with natural gas for the first time, as well as a number of smaller communities along the route of the new line.

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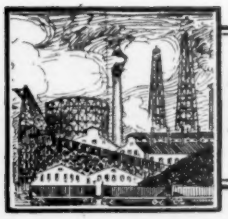


News of the Gas Industry

"Research and Sales" to be Theme of Program of Annual Meeting of the New England Gas Association, March 27-28

Those who have made a comparative study of different industries appreciate that the gas industry is much more comprehensive in its operations than many other industries. That is, there are many more ramifications of a research, technical and sales nature than industries where the production and distribution of the products are relatively simple.

This year, the annual meeting theme is *Research and Sales*. Other important questions will not be overlooked, but these two will be stressed. The two Friday sessions disclose this emphasis, with timely sales papers in the morning and with three pertinent research papers in the afternoon.

The Thursday program: Company Sales Contest Awards; Election of Officers and Directors; Gas Association Work, Alexander Forward Managing Director, American Gas Association; Division Best Paper Awards; The Association's Year, Clark Belden, Executive Secretary, The New England Gas Association; Manufacturers' Association Developments, W. E. Derwent, President, Association of Gas Appliance and Equipment Manufacturers, Vice-President, Geo. D. Roper Corp., Rockford, Ill.; President's Address, John A. Weiser, President, The New England Gas Association, Vice-President and General Manager, The Newport Gas Light Company; The Gas Industry is Ready for the Test, Thomas J. Strickler, President, American Gas Association, Vice-President and General Manager, Kansas City Gas Company; Accounting Changes Indicating Progress, L. A. Mayo, Supervisor, Local Accounts, The Connecticut Light & Power Company; The Servicing Project, R. J. Rutherford, Chairman, N. E. G. A. Servicing Policy Committee, Vice-President, Worcester Gas Light Company; Meeting Peak Loads and Other Technical Developments, Alfred I. Phillips, Editorial Director, *American Gas Journal*, Consulting Engineer; Gas Distribution Under Flow Control, Charles G. Young, Manager, Springfield Gas Light Company; Insurance for Gas Companies, Clarence T. Hubbard, Secretary, Automobile Insurance Co., Hartford.

Thursday Evening: 5-Star Panel Discussion Dinner, presenting Thomas D. Connolly, Director, Program Production and Sales Promotion, Columbia Broadcasting System, New York; Paul Cornell, Past Chairman, American Association of Advertising Agencies, Head Master, Rumford School, Washington, Connecticut; J. Davis Danforth, Vice-President, Batten, Barton, Durstine & Osborn, Inc., New York Advertising Agency; William E. Haskell, Assistant to the President, The Herald Tribune, New York; Harford Powell, Managing Director, Institute of Public Relations, New York.

Friday Program: 1941 Highlights on Sales Possibilities for Industrial and Commercial Gas, Harry W. Smith, Jr., Director, Industrial Publicity, American Gas Association; Selling Gas Heating to the New-Building Market, W. Thompson Fulton, N. E. Sales Representative, Surface Combustion Corp.; The Gas Refrigerator—Past, Present and Future, Geo. S. Jones, Jr., Vice-President and General Sales Manager, Servel, Inc.; Domestic Sales Can Be Increased, E. E. Linburg, Manager, Gas Division, Metropolitan Edison Company, Easton, Pa.; Organization—Experience and Opportunity, Clifford E. Paige, President, The Brooklyn Union Gas Company, Past President, New England Association of Gas Engineers; The Future of America, Dr. Allen A. Stockdale, Speakers' Bureau, National Association of Manufacturers; The People Look at Gas Utilities, Elmo Roper, Market Consultant; An Anchor to Windward, Gustavus J. Esselen, Ph.D., President, Gustavus J. Esselen, Inc., Consulting Chemists and Chemical Engineers, Boston; Market Research—Five Years Later, Lester Ginsburg, Columbia Engineering Corp., New York; Public Utilities and the Economics of National Defense, C. O. Ruggles, Professor of Public Utility Management and Regulation, Director of Research, Harvard Business School.

Home Service Luncheon: Presiding, Lillian P. Dunbar, Chairman, N. E. G. A. Home Service Group, Home Service Director, Brockton Gas Light Company; Remarks of President Elect, Charles G. Young, Manager, Springfield Gas Light Company; Home Service In National Defense, Jane L. Roberts, Director, Home Economics Dept., Roberts and Mander Stove Company.

Lyda Flanders, Home Service Director, Worcester Gas Light Company, will preside at Round-Table Tea at 4 P. M. Friday. Standardizing The Baking Tests, Leader: Dorothy Lowney, Home Service Director, Taunton Gas Light Company; Renovating Recipes, Leader: Kathleen Atkinson, Home Service Director, Providence Gas Company.

800 Cash Prizes Offered in 1941 CP Range Contest

Cash for Membership and Trip Awards to Salesmen; Trophies for Companies

More than 800 cash prizes will be given to leading dealer and utility CP Gas Range salesmen in nation-wide sales contests to be conducted by the American Gas Association in 1941. In addition, top sales producers can win one of 7 all-expense trips to the A.G.A. Convention at Atlantic City in October. Awards to gas companies for outstanding CP sales performance have also been announced by George L. Scofield, Chairman of the A.G.A. Domestic Range Committee. The CP Ranger Club is sponsored by the American Gas Association and all Cash Prizes are donated by the CP Gas Range Manufacturers of the Association of Gas Appliance & Equipment Manufacturers.

Cash prize contests are open to all utility and dealer salesmen registered in the 1941 CP Ranger Club. To insure fair competition, the United States and Canada have been divided into 7 Divisions and all contests will be on a divisional basis between salesmen from communities with approximately the same population and number of domestic gas meters in 1, 2 and 3 family homes.

5 Ways to Win Cash

Contestants earn money rewards in three separate monthly contests, a quarterly competition and by becoming members of the 1941 CP Ranger Club. In monthly contests during March, April and May, a total of 168 cash amounts will be paid out, 56 each month to the salesmen, in each Division, with the largest CP unit sales for the month. For highest total sales during this same three-month period, 140 prizes will be distributed to leading salesmen in each Division.

Cash for achieving membership is a new feature of the 1941 CP Ranger Club. $10 will be paid to every salesman who sells 25 CP models and becomes a CP Ranger and $15 more will be presented to every salesman who sells 50 CP's to become a Star Ranger.

Honor Trips and Trophies

The 7 all-expense trips offered in addition to prize money will be won by salesmen, in each Division, with the largest number of CP installations from January 1 to August 31. Prize winners will be guests of the A.G.A. at its October convention at Atlantic City and will receive wide personal publicity and prestige in recognition of their accomplishments.

While salesmen are vying for cash

prizes, gas companies will be competing for national honor trophies. In each of the seven Divisions, the gas company with the largest number of CP installations per 1,000 one, two and three-family domestic gas meters, from January 2 to December 31, 1941, will receive a distinctive reward symbolic of the achievement. In addition, a National Best Performance Award is offered to gas companies for outstanding CP Gas Range promotions.

Additional information on details and rules of the contest may be obtained from CP Ranger Club, c/o American Gas Association, 420 Lexington Ave., New York, N. Y.

New Standards Adopted

At the last meeting of the A.S.A. Sectional Committee, Project Z21, A.G.A. Approval Requirements Committee, 3 sets of tentative standards, and 1 set of recommended revisions were approved for presentation to the American Standards Association for Adoption. These included requirements and recommended practice for house piping and appliance installation, approval requirements for portable gas baking and roasting ovens, and listing requirements for furnace temperature limit controls and fan controls, as well as revised requirements for semi-rigid tubing and fittings.

Although Requirements for House Piping and Appliance Installation have been available since 1928, it was felt that in view of their wide acceptance throughout the United States and Canada by utilities and various federal, state, and municipal agencies, their significance would be greatly enhanced if adopted as American Standard. After considerable study, these specifications were brought up to date with modern developments and practices. Additions were also made to fully correlate them with applicable features in standards covering installation, maintenance, and use of piping and fittings for city gas sponsored by the National Fire Protection Association. It is believed that this will bring about even greater cooperation by insurance and fire protection interests with Laboratories' activities.

Tentative Requirements for Portable Gas Baking and Roasting Ovens were prepared as a result of increasing demands for Laboratories' approval for this type of equipment. The scope of these requirements applies to ovens which are manufactured, shipped, and are movable from place to place as a unit, including cabinet type ovens and sectional ovens, both of which have stationary decks. Part I specifies basic construction requirements for such equipment for use with all gases. Parts II, III, and IV cover performance requirements for use with city gases, liquefied petroleum, and butane-air gases, respectively. All include details designed to insure the same high standard of safety, durability, and efficiency as have been obtained with other tested and approved gas appliances.

In view of the growing demands for automatic controls on modern central house-heating gas appliances, it was decided some time ago to prepare listing requirements for additional types of such equipment. Availability of such devices listed in the Directory of Approved Gas Appliances and Listed Accessories will enable manufacturers to make a selection most suited for their particular needs. Listing Requirements for Furnace Temperature Limit Controls and Fan Controls are the first of this series of proposed standards prepared. They include suitable tests governing dial calibrations, sensitivity under extreme conditions of usage, as well as continued operation tests to insure satisfactory performance over long periods of service.

Revised American Standard Listing Requirements for Semi-Rigid Tubing and Fittings incorporate a number of major changes. Parts I and II cover construction and performance specifications, respectively, for such parts. Parts III and IV have been added to cover individually tubing and fittings for use in connecting gas appliances to house piping. In addition, current requirements have been strengthened to simulate the most severe use of these accessories in service.

These 4 sets of standards will become effective January 1, 1942. Any manufacturers so desiring may, however, submit their products for test in compliance in advance of that date. Under a recent ruling of the Laboratories Managing Committee, Certificates of Approval or Listing for equipment complying with Requirements which are not yet in effect will be dated as of the effective date of such standards.

The "Servel Annual Best Performance Award" trophy which is being awarded by the A.G.A. Refrigeration Committee to those gas companies which achieve gas refrigerator sales leadership in the Committee's current year-round campaign.

The trophy is made up of three marching men signifying the scientist, the industrial worker and the salesman.

The trophy stands twenty-one inches high. The figures, cast in bronze and nickel plated, stand on an eight inch base of ebonized wood.

At the end of each quarter possession of the trophy is given to those companies which lead their respective classifications for that quarter. Winning companies retain the trophy until won from them by another company at the end of the succeeding three months period. Permanent possession of the award is given to those companies which win the trophy over the full year-round period.

1941 Refrigeration Campaign

At the mid-Winter meeting of the American Gas Association Refrigeration Committee held January 30 in Columbus, Ohio, activities to date on the gas refrigeration campaign since it began October 1, were reviewed, and plans for the third quarter period of April to June were laid.

The meeting was presided over by B. T. Franck, chairman, and vice-president of the Milwaukee Gas Light Co. Mr. Franck stated that this year's gas refrigeration campaign has developed an unusually high pitch of interest.

John W. West, Jr., secretary, and secretary of the Residential Section of the American Gas Association, reported the greatest registration in the history of the Refrigeration Committee campaigns.

Mr. West disclosed that to date this year more than 513 companies throughout the nation had registered. These companies also have registered over 4,500 salesmen. The total number of gas meters represented by the registered companies was reported by Mr. West to be more than 13,000,000.

George S. Jones, Jr., vice-chairman of the Committee, and vice-president and general sales manager of Servel, Inc., reporting on the progress of the campaign in various parts of the country, said that the increasing sales of gas refrigerators is proof that the gas industry is supporting year-round sales of this appliance.

The apartment house market was discussed at length after a report in this field prepared by H. D. Valentine, sales promotion manager of the Peoples Gas Light and Coke Co., Chicago, Ill., was outlined to the meeting. Supplementing this, A. D. Howard, assistant sales promotion manager of Servel, Inc., presented an outline of his company's efforts in this field which will be made available to the gas industry shortly.

W. C. Wolff, domestic sales manager of the Brooklyn (N. Y.) Union Gas Company, was appointed by Mr. Franck to head a sub-committee to study the replacement sales market.

Classified Directory of Gas Appliances

The Association of Gas Appliance and Equipment Manufacturers has issued a directory of members and their products. This is conveniently arranged in three sections: (1) Index of Companies; (2) Index of Products; (3) Index of Trade Names.

Arrangements Are Completed for the Seventeenth Annual Southwestern Gas Measurement Short Course

Committee Meeting of the Southwestern Gas Measurement Short Course, January 17.

In attendance, left to right, standing: W. H. Carson; E. M. Myers; E. C. McAninch; Max K. Watson; J. H. Page; J. H. Satterwhite; William F. Lowe; W. R. McLaughlin: R. M. Scofield; E. L. Stark. Left to right, sitting around the table: Gilbert Estill; Earl Kightlinger; C. A. Gibson; Ray L. Rountree; G. W. McCullough; D. A. Sillers, and Kate A. Niblack.

Other members of the General Committee not present for the picture are: Dr. F. V. L. Patten, E. H. Poe; R. J. Sullivan; C. E. Terrell and W. H. Woods.

Persons approximating 650 or more from all parts of the United States are expected to attend the Seventeenth Annual Southwestern Gas Measurement Short Course which will be held at the University of Oklahoma, College of Engineering, Norman, Oklahoma, April 15, 16 and 17, 1941.

Final arrangements for this annual gathering were discussed at a meeting of the General Committee at the University on January 17, Ray L. Rountree, United Gas Pipe Line Company, Shreveport, Louisiana, presiding at the morning session, and G. W. McCullough, Phillips Petroleum Company, Bartlesville, Oklahoma, Chairman of the Program Committee, presiding at the afternoon session.

Chairmen of other Committees besides Mr. Rountree and Mr. McCullough are: W. H. Carson, Dean of the College of Engineering, University of Oklahoma, Local Arrangements, Banquet and Entertainment; Earl Kightlinger, Arkansas Louisiana Gas Company, Shreveport, Publications; C. A. Gibson, Cities Service Gas Company, Bartlesville Exhibits; R. M. Scofield, Lone Star Gas Company, Dallas, Study of Practical Methods; and, Miss Kate A. Niblack, Oklahoma Utilities Association, Oklahoma City, Registration and Publicity.

At a meeting of the Committee to be held March 10, in Tulsa, Mr. McCullough will present the program for final approval. At this time all business matters in connection with the 1941 Short Course will be transacted.

During the past sixteen years, these Short Courses have attracted 8,392 persons. Six hundred and seventy persons from twenty-one states, Canada and Mexico attended the School last year. Six hundred forty-four companies have sent representatives to the Short Courses in past years.

Except for a banquet session, the delegates spend their time in classes because they must follow a regular schedule each day. During their stay at the University of Oklahoma, they hear discussions and lectures on problems pertaining to the measurement and regulation of dry and casinghead gas. Leading manufacturers exhibit the newest developments in equipment.

To stimulate interest in the Short Course, prizes are awarded those who write the best papers on what they learned during the three-day meeting.

Prize Paper Contest Proves Popular

R. S. Child, Chairman of the Committee on Personnel Practices, declares that a lively interest is being manifested in the A.G.A. Prize Paper Contest on the timely subject "How I Would Increase Public Acceptance of Gas as the Ideal Domestic Fuel."

As announced in our January issue, the contest is open to all employees of member companies of the Association.

To aid companies in publicizing the contest the committee has made available descriptive posters for company bulletin boards and leaflets for distribution. Mr. Child says the response has been so much greater than anticipated that three reprints of the bulletin and leaflet have been necessary to satisfy the demand. In addition, many companies have called attention to the contest in their house organs.

The Philadelphia Electric Company, Central Hudson Gas and Electric Corp., Peoples Natural Gas Company, Boston Consolidated Gas Company and others have offered cash prizes in addition to the national prizes. Some of these company prizes are for the best paper submitted in the national contest by an employee, others are for any employee winning one of the national awards. In the former case papers are to be first submitted to a company prize award committee for local judging after which the papers will be forwarded to the national committee.

There is still time to encourage participation in the contest which closes May 1st, and the committee will be glad to furnish copies of the folder and poster to company members on application to A.G.A. Headquarters.

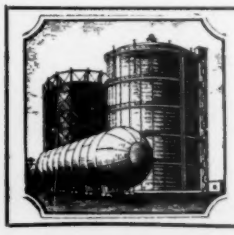
Gas at the Western Metal Congress

Particular attention will be paid by speakers to metals used in production and delivery of gas, when they appear on the program of the Western Metal Congress and Metal Exposition May 19 to 23 in Los Angeles.

The affair will be presented by the American Society for Metals in the Biltmore Hotel and Pan-Pacific Auditorium, in co-operation with 19 other technical societies, including the California Gas and Oil Association, Pacific Coast Gas Association and western branches of the Liquified Petroleum Gas Association.

Expectations are that 50,000 manufacturing plant operators, superintendents, production men, engineers, purchasing agents, metallurgists and metal workers will attend.

A. G. Zima, general chairman, said the theme of the congress and exposition will be "new aids to production," a demonstration of progress to increase quality, economy and speed in the part the metal industry will play in the national defense program.



STACEY BROTHERS
Gas Construction Co., Inc.
"STACEY-KLONNE" & TELESCOPIC GAS HOLDERS "STACEY BULLET" PRESSURE HOLDERS
PURIFIERS AND STEEL PLATE CONSTRUCTION
Executive Offices: Cincinnati, Ohio
Eastern Office: 21 West St., N. Y. C.

Thirty-Third Annual Convention Southern Gas Association

The Thirty-Third Annual Convention of the Southern Gas Association and A. G. A. Regional Gas Sales Conference was held in Dallas, Texas, February 10th and 12th. National defense was stressed throughout the discussions.

D. A. Hulcy, president of Lone Star Gas Co., was the keynote speaker and his subject was "This Industry of Ours." He expressed his confidence that the natural gas industry is prepared to meet any demands made upon it by the National Defense Program and at the same time take care of its normal customers in the usual way.

D. A. Hulcy

In a paper entitled, "Community Development," J. H. Warden of the Oklahoma Natural Gas Company, Tulsa, urged utility companies to take a more active part in promoting the economic welfare of the communities they serve. He stressed the point that the only way we can expect to survive under present day conditions is to have the friendship of our customers and the best way to obtain that friendship is to have them feel that our services are reasonable and adequate.

The Home Service Program was presided over by Fannie May Izard, Mississippi Power and Light Co., Jackson, Miss., Chairman. Nell Read, San Antonio Public Service Co., said that home service in order to succeed must be human and adapted to the local needs of the community in which it operates. The home service director must sense the changing interests of the women in her community and adapt the home service program to fit that need.

Industrial gas sales problems were discussed by a panel composed of H. Carl Wolf, Eugene Milener of the American Gas Association, and A. B. Banowsky, United Gas Corp., Houston.

Many other papers were presented at the meeting, all covering subjects of importance to the gas industry today.

The registration was the largest in the history of the organization. About 85 per cent of the entire membership attended the meeting. Mobile, Ala., was chosen for the 1942 convention and the new officers elected are: H. Carl Wolf, Atlanta, Ga., president; L. B. Denning, Dallas, Texas, first vice-president; Frank C. Smith, Houston, Texas, second vice-president. L. L. Baxter of Fayetteville, Ark., was reelected secretary-treasurer.

The meeting was addressed by T. J. Strickler, President, American Gas Association and Vice-President and General Manager Kansas City Gas Company, Kansas City, Mo. An abstract of Mr. Strickler's talk appears elsewhere in this issue.

Midwest Regional Sales Conference

The 15th Annual Midwest Regional Sales Conference was held at Chicago, February 17th and 18th. E. G. Peabody, sales manager, Citizens Gas & Coke Utility, Indianapolis, Ind., was the Conference Chairman.

The attendance exceeded any previous meeting of the Midwest Conference. There were 700 registrations and 1400 attended the dinner and entertainment.

The papers presented covered a wide range of subjects. The first paper on the program following Chairman Peabody's address was "Crystal Gazing at American Industry," by Clifton M. Utley, Chicago, noted for his radio broadcasts on international affairs.

T. J. Strickler, Vice-president, Kansas City Gas Company and President of the American Gas Association, talked on "The Present Day Need of Aggressive Merchandising." The Monday afternoon session was presided over by Mr. B. H. Wittmann of the Peoples Gas Light & Coke Company, Chicago. R. J. Rutherford, Vice President, Worcester Gas Light Company, talked on the subject, "New Gas Equipment and Its Marketing Possibilities." "Let's Get Down to Cold Facts," was the title of the paper presented by B. T. Franck, V. P., Milwaukee Gas Light Company.

The Tuesday morning session was presided over by J. C. Sackman, Northern Indiana Public Service Co., Hammond, Ind. Some of the papers at this meeting were presented by Edward Vennard, Vice President, Middle West Service Company, Chicago, and Leo J. Heer, Managing Editor, National Furniture Review.

Chairman E. J. Peabody presided at the Tuesday afternoon meeting. "Cooking with Gas," was the title of the paper presented by F. Harold Van Orman, President, Van Orman Hotels, Evansville, Ind. A paper was also presented by Morgan L. Fitch, President, Chicago Real Estate Board.

The Home Service Breakfast was held Tuesday morning and presided over by Karen Fladoes of the Peoples Gas Light & Coke Company, Chicago.

Technologists Needed by the Government

The U. S. Civil Service Commission has announced an open competitive examination to secure Technologists for National Defense work. Difficulty is being experienced in filling positions in such branches of technology as explosives, fuels, plastics, rubber, minerals, and textiles. Persons qualified in these branches are particularly urged to file application. Applications will be rated as received until *December 31, 1941.*

The duties of the positions include the planning, conducting, and reporting of investigation or research in some specialized branch of technology such as explosives, fuels, plastics, rubber, minerals, and textiles; or the testing, designing, or manufacturing of the materials essential for the successful operation of an industrial plant where such plant operation is based on some specialized branch of technology. Applicants must have completed a 4-year college course with specialized major study except that they may substitute, year for year, for the required education, professional experience in the appropriate fields of science, engineering, or technology. In addition, applicants must have had a certain number of years of professional experience in appropriate fields, the number of years varying with the grade of technologist; graduate study in an appropriate field may be substituted for a part of this experience.

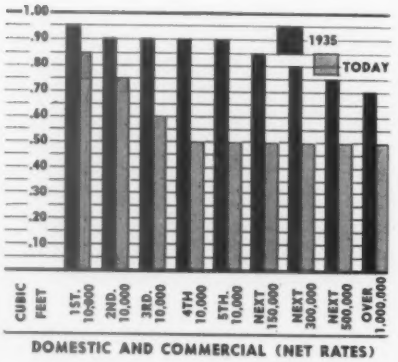
The positions to be filled are in several grades with salaries ranging from $2,600 to $5,600 a year. Competitors will not be given a written test but will be rated upon their education and experience.

Further information and application forms may be obtained from the Secretary of the Board of U. S. Civil Service Examiners at any first- or second-class post office, or from the United States Civil Service Commission, Washington, D. C.

Five Years of Progress Featured in Utility House Organ

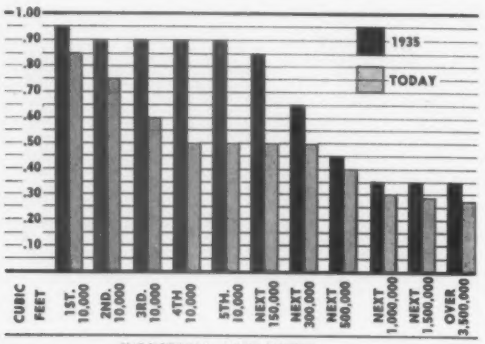
Among the employee monthly and weekly magazines issued by the utilities in the interest of public relations and employee cohesion, an interesting number is the February issue of *The Gas Flame* of The Citizens Gas & Coke Utility of Indianapolis, edited by George A. Sass, advertising manager for the company.

Following an illustrated description of progress in the erection of their new 12 million foot waterless gas holder, a two page center spread is devoted to "Five Years of Progress, 1935-40."



DOMESTIC AND COMMERCIAL (NET RATES)

HOUSE HEATING NET RATE



INDUSTRIAL (NET RATES)

By means of graphs, reproduced here, a rate schedule comparison is made between 1935 and 1940 covering domestic and commercial, house heating as well as industrial net rates.

A parallel comparison is made showing growth of the system and gas consumption in 1940 as compared with 1935. This may be condensed into tabular form as follows:

	1935	*1940*	*% Increase*
Miles of mains	872	1,119	28.2
Meters in use.	77,364	93,018	20.2
Gas Consumption (M.C.F.)			
Domestic & House Htg..	2,214,467	2,509,532	33+
Commercial.	268,000	369,000	37+
Industrial ..	550,000	1,000,000+	110
Total		4,429,951	46

Home service, employee activities and social affairs and personals round out an interesting bulletin which gives also the company's financial statement. The cover illustration features a new half million cubic foot gas compressor recently installed.

Koppers Co. Consolidates New York Headquarters

Consolidation of New York city headquarters for three Koppers Company divisions and an affiliated company at 60 East Forty-second street, has been announced.

Koppers Company, Tar and Chemical Division is establishing New York headquarters for the first time. The Wood Preserving and Gas and Coke Divisions and The Koppers Coal Company, a Koppers Company affiliate, are moving from 90 Broad Street.

Tulsa District Office of Pittsburgh Equitable — Merco Nordstrom Holds Annual Sales Conference

During the week of January 6 the Pittsburgh Equitable Meter Company and Merco Nordstrom Valve Company salesmen in the Southwest gathered at the company's Tulsa plant for an intensive sales meeting. Many different subjects were covered pertaining not only to sales but also to engineering, according to A. J. Kerr, District Manager. Discussions were held on the company's various types of meters, regulators and valves used by the water, gas and petroleum industries.

Captain A. E. Higgins, Vice-President in Charge of Sales, and A. D. MacLean, Vice-President and Chief Engineer, attended from the company headquarters in Pittsburgh. Similar conferences are now being held in other districts.

Captain Higgins recently completed a coast-to-coast tour by air to attend the various District Sales Meetings held by the two companies.

The accompanying picture, taken during his visit to Columbia, S. C., where the Southeastern District Sales Meeting was held in January, shows Mr. W. S. Tomlinson, City Engineer, Columbia; Captain Higgins; Fred Swaffield, Jr. and F. G. Swaffield, District Manager.

Front row, left to right: L. R. Van Arsdale, W. R. McLaughlin, F. A. Arnesen; Captain Higgins, Vice President and Sales Mgr.; J. L. Cottrell; A. J. Kerr, District Mgr.; A. D. MacLean, Vice President and Chief Engineer; Roy R. Bush; O. W. Barnett; Dean D. Collins. Back row, left to right: L. A. Babin, M. D. Gilbert, J. W. Northcutt, Herbert Parker, J. E. B. Lundy, Carl E. Baird, C. K. Madison, Glynn De Haas, F. N. Dillman, Tom Stacy.

Luncheon given by Robertshaw Thermostat Co. at the Waldorf Astoria on February 14th.

Robertshaw Thermostat Company Announces Educational Service for Home Economics Teachers

At luncheons at the Blackstone Hotel, Chicago, on February 7th and at the Waldorf Astoria on February 14, the Robertshaw Thermostat Co. announced its new Education Service for home economics teachers. At these luncheons were large groups of women editors and home economic editors of national magazines, farm papers, and newspapers; editors of trade and home economics publications, directors of home economics of leading colleges and universities, county home demonstration agents and the home economics directors of public utility companies.

Speakers at the luncheon were Mr. J. A. Robertshaw, President and Mr. H. T. Ryan, Vice President of the Robertshaw Thermostat Co., Youngwood, Pa., who outlined the history, background, and present developments in oven heat control. Miss Howe, co-editor of What's New In Home Economics, home economist, radio lecturer, writer and author presented the technical discussion of the scientific study upon which this educational service is based.

The new Educational Service presents for the first time a complete and scientific study of the importance of accurately measured heat upon baking and roasting. It covers such subjects as Heat vs. Measured Heat, Measured Heat—How Attained, Factors Which Affect The Proper Functioning of an Oven, Measured Heat as a Leavening Agent. In picture and word it explains the importance of optimum temperature and the undesirable effects of excessive or deficient heat.

A 24-page textbook is provided for teachers. It is profusely illustrated with photographs of finished products showing the outside as well as the texture of pop-overs, biscuits, muffins, pastry, bread, shortened cakes, sponge cake, etc., baked at optimum temperature as well as the comparative results when the exact same recipes were baked at too high or too low a temperature. Large illustrated wall charts for classroom use are also provided as well as a student folder which gives the complete story of Measured Heat in form that students can use in their notebooks or carry home. This material is now in the hands of more than 6,000 home economics teachers in schools and colleges in every state of the Nation.

The influence of this important educational group reaches three million students in schools and four million home makers. By means of such a program it is hoped that the large group of homes, apartments, etc., now without oven heat control might be reached and the benefits of modern equipment clearly and convincingly laid before them, thereby materially increasing sales of modern heat-controlled ranges.

Renown Stove Company Elects Officers

New officers elected at the annual meeting of Renown Stove Company, Owosso, Michigan, on February 17th are B. A. Nagelvoort, President, succeeding J. E. Ellis, who resigned last November. Nagelvoort has been associated with Renown since September, 1932, having served as Secretary and Treasurer since that date and as General Manager since 1936.

Walter C. Howe, who joined the company in 1933, became Secretary and Treasurer. He had been Assistant Treasurer since August, 1936. Frank W. Rayen was made Assistant Treasurer.

New Ironcase Meter Booklet

American Meter Company's revised new Catalog EG-40 on Metric-American Ironcase Meters gives a comprehensive, up-to-the-minute report on developments in these types of meters (for both low and high pressures) to meet all requirements and exigencies of present-day service.

The facts are based not only upon engineering activities and tests, but also on a large cross-section of approved installations in the field.

Design, construction and maintenance features of regular and special Ironcase meter types are described in detail, and complete specifications presented. Correct use of Westcott-American volume and pressure gages, and Metric-American base pressure and base volume indexes, in connection with Ironcase meters, also is discussed.

The booklet, of standard file size, is handsomely illustrated and arranged for convenient reference. A copy may be had by addressing American Meter Company, 60 E. 42nd Street, New York City, or the office of that company nearest you.

Natural Gas and Petroleum Assn. of Canada

The Eighteenth Annual Convention of The Natural Gas and Petroleum Association of Canada will be held at the Royal Connaught Hotel, Hamilton, Ontario, on May 22nd and 23rd.

The Business Session, which is the opening meeting of the Convention, will be held for the presentation of reports, appointment of committees and the transaction of such other business as may come before the meeting.

On the 23rd, the morning and afternoon sessions will be devoted to papers, discussion and a questionnaire on problems of interest to the natural gas industry.

The Convention will close with the Annual Banquet on Friday evening, May 23rd, at which there will be an outstanding speaker and pleasing entertainment.

Gas Range Sales Drive

A nationwide gas range sales campaign will be conducted this Spring and Summer by the Association of Gas Appliance and Equipment Manufacturers and the American Gas Association, stressing the slogan, "For Everyone In Forty-One It's CP." The extensive campaign was recently introduced to the public by the CP Gas Range manufacturers through utility companies and dealers throughout the United States.

The campaign, which contains numerous advertising and merchandising suggestions, has been planned for the continued promotion and sale of Certified Performance gas ranges which were introduced to the public less than three years ago through progressive promotional activities.

A comprehensive sales plan book recently distributed by the CP gas range manufacturers to utility companies and dealers throughout the country includes tested promotional pieces, suggested newspaper advertisements, direct mail pieces, window and floor display suggestions, bill enclosures, radio announcements, and various educational and contest plans for creative sales promotion.

Prize Photo Contest Announced by Connelly

Gas men throughout the country who are camera enthusiasts will be interested in the amateur photographic contest just announced by Connelly Iron Sponge & Governor Company of Chicago, Illinois and Elizabeth, New Jersey.

Seventeen prizes totalling $255.00 in cash are being offered. The contest, which runs from March 1st to June 30th, 1941, is open only to gas company employees and their families.

Contest Rules

1. Competition is open only to officers and employees of any gas company in the U. S. A. and Canada and members of their families.

CONVENTION CALENDAR

March

6-7 *Pacific Goast Gas Assn.*, Spring Sales Conference, Los Angeles.

13-14 *A. G. A. Industrial Gas Sales Conference*, Baltimore, Md.

17-18 *Oklahoma Utilities Assn.*, Tulsa, Okla.

27-28 *New England Gas Association*, Hotel Statler, Boston, Mass.

April

9-10 *Fourth Annual Midwest Power Conference*, Palmer House, Chicago.

14-16 *Mid-West Gas Association*, Hotel Nicollet, Minneapolis, Minn.

15-17 *Southwestern Gas Measurement Short Course*, University of Oklahoma, Norman, Okla.

21-22 *Gas Meters Association of Florida and South Georgia*, Hollywood, Fla.

21-23 *A. G. A. Distribution Conference*, Pittsburgh, Pa.

23-25 *Missouri Assn. of Public Utilities*, Elms Hotel, Excelsior Springs, Mo.

24-25 *A. G. A. Hotel, Restaurant and Commercial Sales Conference*, Chicago, Ill.

May

5-8 *A. G. A. Natural Gas Section Convention*, Adolphus and Baker Hotels, Dallas, Texas.

12-14 *Pennsylvania Gas Association*, Skytop, Pa.

19-21 *A. G. A. Production and Chemical Conference*, New York, N. Y.

20-21 *Canadian Gas Association*, Hamilton, Ontario.

22-23 *Natural Gas and Petroleum Association of Canada*, Hamilton, Ontario.

June

3-5 *Annual Convention A. G. A. E. M.*, Ambassador Hotel, Los Angeles, Cal.

30 to July 2 *Michigan Gas Assn.*, Grand Hotel, Mackinac Island.

September

8-10 *Mid-West Gas School and Conference*, Ames, Iowa.

11-12 *Empire State Gas & Elec. Assn.*, Saranac Inn, New York.

October

6-10 *National Safety Congress and Exposition*, Chicago, Ill.

20-24 *American Gas Assn. 25th Annual Convention*, Atlantic City, N. J.

2. Contest starts March 1, 1941 and ends June 30, 1941. All entries must be postmarked not later than midnight June 30, 1941.

3. Contestants may enter as many prints as desired and in any or all classifications, but each print must be accompanied by an official entry blank properly filled out.

4. If contestant wishes photographs returned, they must be accompanied by sufficient return postage.

5. To be eligible, all prints must be not smaller than 2¼"x3¼". Contest is confined to black and white photographs only.

6. All prints must be mounted and the name and address of the entrant plainly marked on the back.

7. While the greatest possible care will be exercised in the handling of prints, no responsibility can be assumed by Connelly Iron Sponge & Governor Company for loss or damage to prints submitted.

8. Prize winning prints will become the property of Connelly Iron Sponge & Governor Company with the understanding that they may be used for reproduction or advertising purposes whenever desired.

9. Decision of the judges, whose names will be announced later, will be final.

10. In case of a tie for any prize, duplicate prizes will be awarded.

11. All entries and communications should be addressed to Contest Manager, Connelly Iron Sponge & Governor Company, 3154 S. California Avenue, Chicago, Illinois.

12. All photographs entered will be judged on the basis of composition and technical execution as well as pictorial value and appropriateness of subject.

Prizes and Classifications

A grand prize of $100 is offered for the photograph which in the opinion of the judges is the best of all photographs submitted. Class prizes will be awarded as follows:

Class 1. Photographs featuring purifying equipment or material used in the production or utilization of manufactured gas.

First Prize—$25.00
Second Prize—$10.00

Class 2. Photographs featuring the iron oxide method of purification of natural gas.

First Prize—$25.00
Second Prize—$10.00

Class 3. Photographs featuring Connelly apparatus in use in the gas industry, such as Governors, Regulators, Back Pressure Valves, Smyly Automatic Loaders, H_2S Testers, Caloroptics or any installations of same.

First Prize—$25.00
Second Prize—$10.00

In addition, 10 prizes of $5.00 each will be awarded for entries, regardless of classification, which in the judges' opinion are worthy of special recognition.

Also, Connelly Iron Sponge & Governor Company will pay $3.00 for any print used for advertising. This does not apply to prize winning pictures.

Entry blanks for this contest may be had by writing the Contest Manager, Connelly Iron Sponge & Governor Company, 3154 S. California Avenue, Chicago, Illinois.

INDEX TO ADVERTISERS

American Meter Co. 8
Autogas Corporation 17

Barber Gas Burner Co., The 32
Besse, Osborn & Odell ..... —
Blaw-Knox Company ..... —

Carbide & Carbon Chemicals Corp. ..... —
Cast Iron Pipe Research Assn., The ..... —
Chaplin-Fulton Mfg. Co., The 38
Cleveland Gas Meter Co. ..... —
Cleveland Trencher Co. 34
Coal Carbonizing Co. 38
Connelly Iron Sponge & Governor Co. 34
Cribben & Sexton Co. 6
Cruse-Kemper Co. 34

Dresser Mfg. Co. ..... —

Gas Machinery Co. ..... —
Gas Purifying Materials Co. 49
General Coal Co. ..... —

Harper-Wyman Co. 23-26

Lambert Meter Co., Inc. 41
Lattner Mfg. Co., P. M. 49
Lavino & Co., E. J. 28

Merco-Norstrom Valve Co. 2
Metric Metal Works 8
Monmouth Products Co. 32

Paramount Products Co. 38
Partlow Corp., The ..... —
Phillips, Alfred I. 41
Pittsburgh Coal Co. ..... —
Pittsburgh Equitable Meter Co. 2

Reed Manufacturing Co. 27
Remington Rand Co. ..... —
Republic Heaters Sales Co. 17
Reynolds Gas Regulator Co. 28
Roberts-Gordon Appliance Corp. ..... —
Robertshaw Thermostat Co. ..... Front Cover
Roper Corp., Geo. D. 4
Ruud Manufacturing Co. ..... —

Safety Gas Main Stopper Co. 41
Semet-Solvay Engineering Corp. 3
Servel Electrolux Div. ..... —
Skinner Co., M. B. 5
Sprague Meter Co., The ..... Fourth Cover
Stacey Bros. Gas Construction Co. 44
Superior Meter Company 38

Titan Valve & Mfg. Co., The ..... —

Union Carbide & Carbon Corp. ..... —
United Engineers & Constructors, Inc. 41

Vulcan Proofing Co. ..... —

West Gas Improvement Co. ..... —
Worthington Pump and Machinery Corp. ..... —

A Book for Gas Appliance Salesmen

Domestic Gas Appliances by A. M. Apmann. Gives practical working knowledge of the technology of appliances and characteristics of fuels. Ranges, Water Heaters, House Heating and Refrigeration are fully discussed. 238 pages, many illustrations, stiff cover. Special close-out price, 50c. American Gas Journal, 53 Park Place, New York.

Position Wanted—Gas Meter Repairer

I would like a position as a gas meter repairer or supervising a gas plant that wishes to repair its own gas meters. I am thirty-three years of age. I have had sixteen years of experience in the following: Gas meter repairer, gassing, and proving gas meters. I can obtain any references regarding my previous employment. Address Box 118, c/o American Gas Journal, 53 Park Place, New York City.

Brooklyn Union Gas Company Leads U. S. In Big Servel Units

The first 100 commercial refrigeration jobs have been installed in Brooklyn and Queens, Commercial Sales Manager Fred C. Neuls has announced. These are spread through restaurants, taverns, florists, meat markets, bakeries and delicatessens.

These sales place the company far out in front as a pioneer in commercial refrigeration installations, and have added approximately 20 million cubic feet annually to the company load.

Gas Man Appointed To Restaurant Association Exhibitor's Committee

Appointment has been made of T. J. Gallagher, Manager, Commercial Sales Department, The Peoples Gas Light and Coke Company, Chicago, to the Exhibitor's Committee of the National Restaurant Association—the group charged with the responsibility of planning all aspects of the 1941 National Restaurant Exposition to be held October 6-10 in Chicago in connection with the annual convention of the National Restaurant Association.

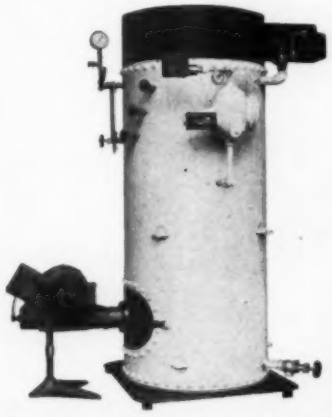
The *Test* of REPETITION

A STABLE & PROGRESSIVE industry operates on a stable & progressive policy. *"I know of no way of judging the future but by the past,"* said Patrick Henry. In 1940 GPM shipped 1,750,000 bushels of iron boring oxide sponge of which 1,500,000 were repeat orders.

Gas Purifying Materials Company
Long Island City, N. Y.

GPM IRON HYDROXIDE

LATTNER GAS — OIL BOILER 3 HP to 35 HP.



Burns natural gas or regular furnace oils with equal efficiency.

P. M. Lattner Mfg. Company
Cedar Rapids, Iowa

A.G.A.E.M. CP Manufacturers Present Gift To Agee

R. S. Agee on leaving his position as sales promotion manager of the Association of Gas Appliance and Equipment Manufacturers, January 31, to become vice president of Roberts & Mander Stove Co., Hatboro, Pa., was presented with a solid bronze desk set by the CP Gas Range Manufacturers "as a symbol of the high regard in which he was held during his three years with the Association." C. W. Berghorn, A.G.A.E.M. managing director, made the presentation.

While the manufacturers were unable to be present, their good wishes were expressed by Lloyd C. Ginn, chairman of the Domestic Gas Range Division's sales management committee, in a letter as follows:

"On behalf of the CP Gas Range Manufacturers whom you have served tirelessly and effectively for three years, we send you this gift which we hope may symbolize in a concrete way our appreciation and respect for so singular and outstanding a contribution to the gas range industry."

Mr. Agee's first reply was, "This is one of the few times in my life when I am speechless." However, he assured those at the presentation that his gratitude and appreciation to the CP range manufacturers, the Association and staff, was such it could not be measured in words.

Obituary

WILLIAM H. GARTLEY

William H. Gartley, long connected with the Philadelphia Gas Works Co., and The United Gas Improvement Co., Philadelphia, Pa., died February 13, age 81. In 1877, on completion of his freshman year at Cornell University, Mr. Gartley received an appointment to the United States Naval Academy, Annapolis, and graduated in 1881, completing his course of instruction during a two year cruise of the U. S. S. Essex.

Having left the service in 1883, he became a draftsman with the Baldwin Locomotive Works. After about a year with Baldwin's, he accepted a position as draftsman and engineer with the Lowe Manufacturing Co., of which Professor T. S. C. Lowe, the inventor of the carburetted water gas process, was the Chief.

Wm. H. Gartley

Thus W. H. Gartley became one of the pioneers in the development of the manufacture of carburetted water gas—something new in 1884—today, in general use in the United States and other parts of the civilized world wherever oil is obtainable. Several of the important developments of this method of fuel or illuminating gas production, as we know it, are attributable either directly or indirectly to him.

He left the Lowe Manufacturing Co. in 1885 to become Chief Engineer of the National Gas Light & Fuel Co. of Chicago —builders of water gas plants.

In the years 1887-1888 a company, known as the Philadelphia Gas Improvement Co., having obtained rights under the Lowe patents, had built a carburetted water gas plant on property owned by the city of Philadelphia adjacent to the city's 25th Ward Gas Works (Richmond Works), and in April, 1888 entered into a contract to produce and sell to the city gas of relatively high illuminating value, for mixture with the gas of lower illuminating value produced by the city's coal gas works.

In 1889 W. H. Gartley became Chief Engineer of this company and was in charge of this water gas works—the main buildings of which are in use today at the Richmond Works.

In 1892 the United Gas Improvement Co. succeeded the Philadelphia Gas Improvement Co. as owners and operators of that plant, retaining Mr. Gartley as Chief Engineer.

On December 1, 1897, began the 30-year lease of all Philadelphia's gas production and distribution facilities to the United Gas Improvement Co. From that date to March 30, 1926, Mr. Gartley held the position of Engineer of Works of the entire Philadelphia Gas Works. On the latter date he was given the title of Chief Engineer, and on January 1, 1928, that of Vice-President in Charge of Engineering.

He retired from active duty December 31, 1931, as an honorary Vice-President of the United Gas Improvement Co.

He was given in 1916 assignment as a member of the Committee on Coal Tar By-Products for the Chemical Committee of the Council of National Defense.

In 1928, in recognition of his many services to the Gas Industry, he was awarded the Walton Clark Medal of the Franklin Institute of Philadelphia.

In 1906, he received the Beal Medal from the American Gas Institute for the best technical paper of the year.

DAVID J. COLLINS

David Judkins Collins, for almost 45 years a prominent figure in gas utility sales work in Philadelphia, died February 2nd at his home in Swarthmore. He would have been 81 years old within a few months.

His utility career started in 1885, with The United Gas Improvement Company. With the exception of a few years spent in the Engineering Department of the Omaha (Nebraska) Gas Company, he had remained continuously in the sales divisions of U. G. I., The U. G. I. Contacting Company, of which he was vice-president in charge of sales, and United Engineers & Constructors Inc. During those years until 1929, when he retired, he had gained a nation wide reputation in the gas industry for his work on the development and sales of U. G. I. gas apparatus. For some years following his retirement, he continued as gas sales consultant with United Engineers & Constructors Inc.

In addition to his gas utility sales work, Mr. Collins had long been identified with the Tampa (Florida) Gas Company.

CHARLES A. STONE

Charles A. Stone, chairman of the board of Stone & Webster, Inc., with main offices at 90 Broad Street, of which he was a co-founder, died of pneumonia Feb. 25th at his home in New York, after a brief illness. He was seventy-four years old.

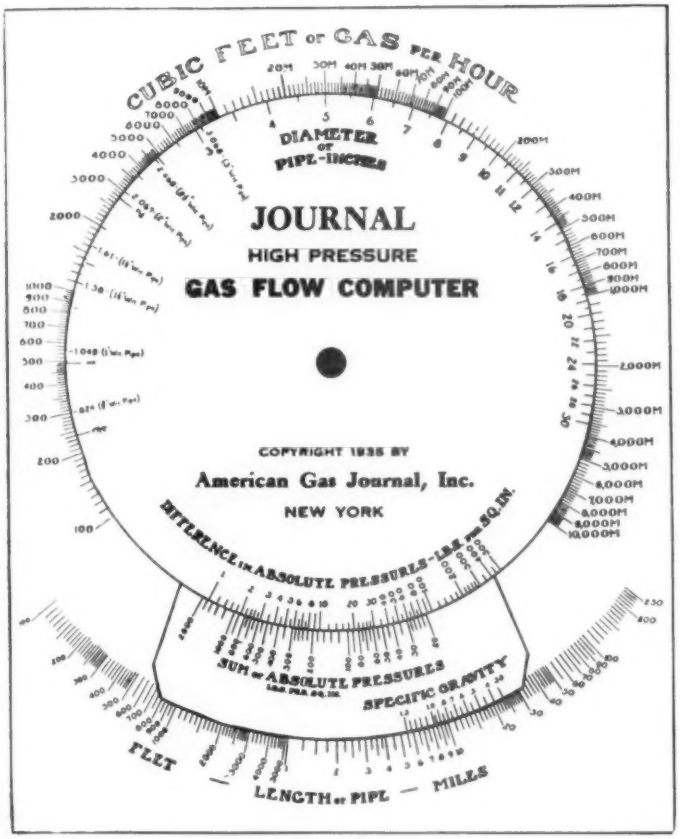
With Edwin S. Webster, a classmate at the Massachusetts Institute of Technology, Mr. Stone set up a consulting engineering business in 1889, with a capital of $4,000, that expanded into a national organization whose services today include engineering construction for all types of industry, the underwriting and distribution of securities and the supervision of electric, gas and transportation properties.

J. M. BURCHILL

Joseph Michael Burchill, Vice-President and a director of the American Gas and Electric Company and its subsidiary, the American Gas and Electric Service Corporation, died Feb. 15 at his home, Forest Hills, N. Y. He was forty-six years old.

A native of New York City, he attended public schools before going to work in Philadelphia for the American Electric Power Company. When that company was taken over by the American Gas and Electric Company in 1925, he returned to New York. For some years he had been vice-president of the company, specializing in the field of finance.

"Journal" Gas Flow Computers



New Improved Gas Flow Computers now available of durable celluloid, encased in a convenient leatherette cover with complete instructions.

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Diameter of Pipe Inches ¾-30
Difference in Absolute Pressure—Lbs. per sq. in. 1-500
Sum of Absolute Pressures—Lbs. per sq. in 2000-20
Specific Gravity 1.5-.35
Length of Pipe—Feet 100-5000
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Low Pressure Computer Range:

Cu. Ft. of Gas Per Hour—10 to 500 M
Pipe Diameter ¾" to 48" (including standard and actual weight up to 4")
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Length of Pipe—Feet 30-30,000
Specific Gravity 1.5-.35
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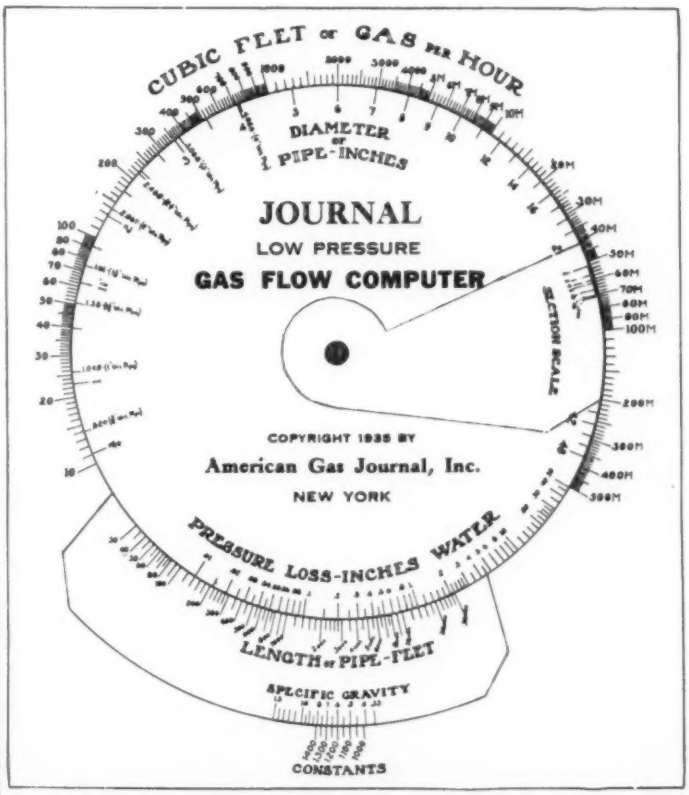

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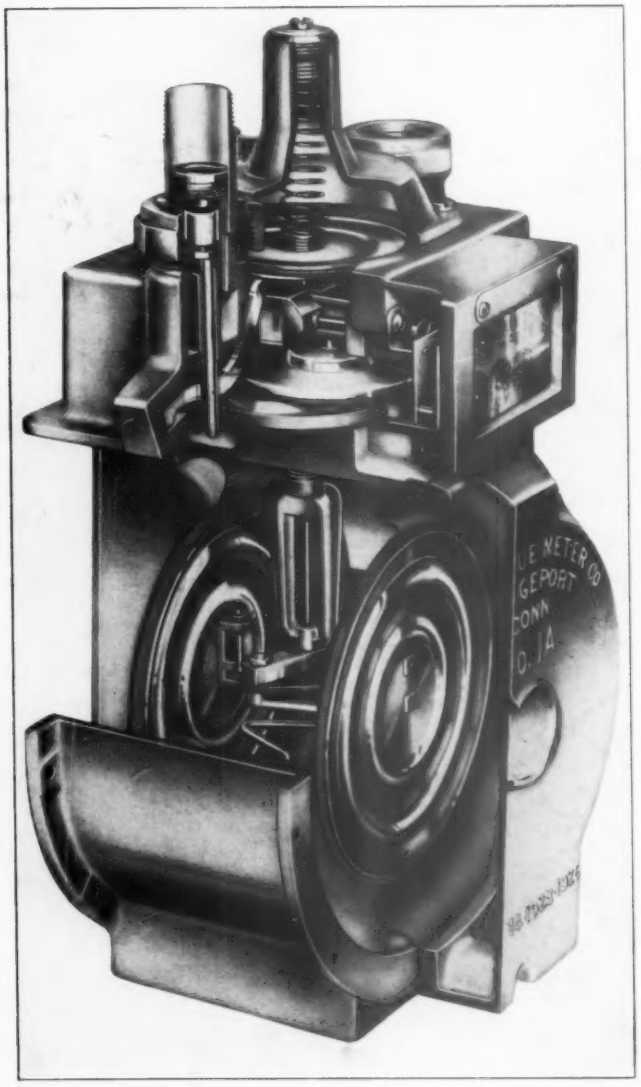

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